

The CACNews



The President's Desk

CAC: All Generations Welcome

Well, another year has passed, and we finished 2012 with another great seminar. Dr. Steven Lee, the chair of the Fall 2012 Seminar did an outstanding job of organizing and hosting. None of us will forget Dr. Sensabaugh's Founders Lecture and the banquet where we celebrated his retirement and contributions to our profession. For me personally, the highlight of the seminar was the entire general session. Dr. Lee managed to pack the seminar with a full spectrum of topics. They included (but were not limited to): new fingerprint development technology, trace analysis (and the meanings of those findings), NIST's latest research in firearms identification, and a glimpse into the future of DNA: rapid whole genome sequencing. The presenters traveled from across the country and even from around the world. Those of us who attended the meeting were the lucky benefactors of Dr. Lee's ability to attract both a variety and high quality of presenters.

Of course, Dr. Lee didn't plan and run the whole meeting by himself. He had a dedicated group of San Jose State University students and other volunteers. Thanks to Dr. Lee and the team of volunteers, the seminar was a total success.

I want to close by revisiting the previous *CACNews*, and talk more about the "Proceedings of Dinner: Bridging Generations" [1]. At the Fall Seminar, the authors of the article participated in a panel discussion to share their opinions and feelings about generational differences. After hearing their thoughts (and re-reading the article), I sensed there is concern for our profession and the younger generation.

Based on my experience as president of the CAC, I'm not concerned for the future of criminalistics. I am continually amazed at the willingness of individuals to volunteer their time to the CAC. Most the CAC's work is done by our committees, study groups and other volunteers. The criminalists who make up the CAC's study group chairs, committee members and board of directors come from all generations. They fulfill their responsibilities without being asked and without reward. Additionally, when we need extra help, time after time, criminalists step-up, get the job done without complaint and ahead of schedule. There is genuine dedication to criminalistics and that dedication is found within the daily functions of our professional society.

As one of many examples, I want to highlight the Historical Committee. They will soon begin the process of organizing and archiving the CAC's historical documents. Over the years, we've amassed a significant volume of documents from our founders. The LAPD and LASO laboratories have been generous and offered a storage space for these documents. So, while our legacy has a home, the documents are not being properly stored. Acidic paper, staples and other contaminants will eventually degrade the paper and photographs contained in our archives. This winter and spring, the Historical Committee, in conjunction with a professional archiving company, will categorize and then transfer the documents to suitable long-term method of storage. This will ensure that our history, knowledge and wisdom of our founders will be preserved for future generations.

please turn to page five

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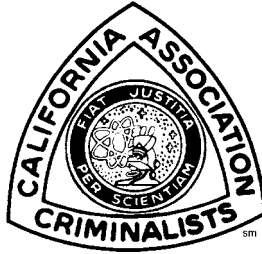


Todd Weller
CAC President

The CACNews

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The deadlines for submissions are: December 1, March 1, June 1 and August 15.



On the cover...

Retiring George Sensabaugh gets a banquet of honors at the 2012 fall CAC seminar in San Jose. More photos inside.

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CACBits



CAC President Todd Weller (r) presents Greg Laskowski with the Al Biasotti Award.

Award for Most Outstanding Paper

Greg Laskowski received the Alfred A. Biasotti Most Outstanding Presentation Award for his paper "Unusual Toolmark/Fracture Case" presented at the Spring 2012 CAC meeting in Bakersfield. Laskowski says, "I am astonished, yet honored to once again receive this prestigious award. Please direct the award stipend to the CAC scholarship fund. I am sure there is a deserving student or intern who can use the money to further his or her education by attending one of the meetings."

Pat Campos 1949-2012

Patrick Campos, a regular supporter of CAC seminars and a favorite among vendors, passed away on August 31st after a brief illness. He leaves his wife Susan and son Clay.

Pat had been the Western Regional Sales Manager for NanoAnalysis since 1985. Many of you will be familiar with



Pat, he was well known and well liked. His wit, charm and unbridled enthusiasm for Oxford Instruments was unmatched.

Oxford says they will be bringing a replacement into the territory in the near future, but in the meantime, for questions please contact Ruth Murray, National Sales Manager email: ruth.murray@oxinst.com.

From an obituary published in the *San Francisco Chronicle* on September 9, 2012: "Ask around, and people will tell you that when Pat was in the room there was nary an empty wineglass nor a silence to be filled. Patrick will be greatly missed."

Free Online Statistics Course

Go to www.udacity.com/courses and click on Introduction to Statistics: Making Decision Based on Data (ST1010)

If they are like me, many CAC members may be weak in statistics. This free online course may be of interest to readers of CACNews.

From the website: "This course does not require any previous knowledge of statistics. Basic familiarity with algebra such as knowing how to compute the mean, median and mode of a set of numbers will be helpful."

—Bob Blackledge



Dave Stockwell delivers a moving address upon receiving the 2012 CAC Anthony Longhetti Distinguished Member Award at the fall seminar banquet in San Jose.

For Your Calendar—Upcoming CAC Meetings

Spring 2013, hosted by Cal. State LA, contact Kathy Roberts. The Pasadena Hilton has been selected for this meeting from May 19-24, Rooms: \$125 (all prices before tax).

Fall 2013, Hosted by Calif. Dept. of Justice, Central Valley Lab., contact Chris Schneider. The Hilton Modesto has been selected for the meeting from Oct 21-26, Rooms: \$84.

Spring 2014, hosted by San Diego Sheriff, contact Connie Milton. The Westgate Hotel has been selected for May 5-9, Rooms: \$133.

Fall 2014, Reno, NV. This will be a joint meeting between the CAC and the Northwest Association (NWAFS).

Spring 2015, hosted by Ventura County Sheriff.

(Visit cacnews.org for information as it becomes available)

Report: Regional Director, South

Los Angeles County Sheriff's Department hosted the last study group meeting on October 23, 2012 at the Hertzberg-Davis Forensic Science Center/LA Regional Laboratory.

Ken Sewell coordinated the study group meeting.

Edward M. Nordskog spoke on Arson Motives and Profiling the Fire Science as it relates to connecting forensics to a potential suspect or group of suspects.

Approximately 70 people were in attendance for the luncheon. Study groups that met: Arson & Trace (joint), DNA, Quality Assurance. Drugs & Toxicology (joint).

Lynne D. Herold has agreed to be the interim Trace Study Group Chair. Steve Cordes would like to resign as the CSI study group chair.

—Mey Tann

Report: Regional Director, North

On August 30th the DNA Technical Leaders group visited IntegenX where they toured the factory and saw a presentation on their equipment.

I am currently looking at mid-February for the next study group meeting, likely to be hosted by Santa Clara County Sheriff's Lab.

Two questions were posed by QA Study group chair Stephanie Williams that I would like feedback from the Board on. First, she inquired about starting a group on the website LinkedIn for the QA group. Does the Board have a stand on social media presence? Second, she would like to fly in a speaker from Washington state to discuss uncertainty of measurement for blood alcohol. Confirmation from two interested individuals pending.

Paulette Sanchez and Melissa Kramer resigned as the study group co-chairs for blood alcohol.

Jennifer Rattanaprasit from San Bernardino County Sheriff's Dept SID is the new BA chair.

—Meghan Mannion-Gray

Forensic Anthropology Course Offered

The 26th Annual NMHM Forensic Anthropology Course (Formerly the AFIP Course) is to be held at the Maryland Office of Chief Medical Examiner, Baltimore, Maryland, June 3—7, 2013. This link takes you to the registration website: hjfcvent.com/2013ForensicAnthropology

Click on the buttons on the left of the webpage to review the agenda, fees, location, hotel information, CME details and faculty list.

Contact: Robyn Hulvey, rhulvey@hjfc.org The Henry M. Jackson Found. for the Adv. of Military Medicine, Inc.

Inter/Micro 2013—Call for Papers

McCrone Research Institute cordially invites you to participate in Inter/Micro 2013 (July 15-19, Chicago). This is the premier international microscopy conference! Speakers receive a \$75 registration discount.

Papers are being solicited in micro-analytical techniques and instrumentation, environmental and industrial microscopy, and chemical and forensic microscopy. See a detailed list of presentation topics and complete abstract guidelines.

The deadline to submit titles and abstracts is April 15, 2013.

Inter/Micro 2013 presentations will be held at McCrone Research Institute at 9 a.m.-5 p.m. on July 15-17.

For more information, visit the Inter/Micro 2013 section on www.mcri.org, or contact us at 312-842-7100 or intermicro@mcri.org.

The President's Desk *cont'd*

Unfortunately, the archives will not organize itself, and the CAC will need volunteers to help with the sorting, categorizing and filing. Keep an eye on our website and your email for ways in which you can help with this important project.

1. Rudin, N., Inman, K. The Proceedings of Dinner: Bridging the Generations. *The CACNews*, 4th Q 2012, pp. 8-10.

Steve Lee shares his list of students and volunteers who each helped make the seminar a success:

Kait Badeaux, Jasmeet Deol, Marilyn Rosa. Deserve separate mention for their countless hours of volunteer work, organizing the conference and volunteering all week at registration, helping with every task and keeping us all together!

Waliana Dieu for all her work with the vendors, printing the program, ordering the bags, putting together tickets, teaching me how to use Mail-merge for certificates printing and overall organizational help.

Ines Iglesias-Lee, Dr. John Bond, Luis Sandoval for helping put together the bags and programs.

Phil Nhan for assisting with the Forensic Anthropology workshop.

Session and Workshop Volunteers including Monica Madej, Ryan Yee, Jesse Ramirez, Arlene Carmago, Rachel Lopez, Stefanie Cuevo, Erika Riparup, Damaris Mendoza and Jason Brice.

Dr. Ian Fitch and Brooke Barloewen from the Santa Clara County Crime Laboratory for providing space for the workshops and for coordinating these moderators: Jocelyn Weart, Dr. John DeHaan, Brad Dixon, Brian Karp and Kevin Kellogg.



The Editor's Desk

Generations Continued, Plus ...

The last issue of the *CACNews* contained the usual mix of technical papers, interesting forensic science tidbits and regular features. One of the regular features, The Proceedings of Lunch, which does not shy away from controversial issues and concepts, dealt with an issue guaranteed to raise a few eyebrows and possibly anger many of our members. That issue's article "The Proceedings of Dinner: Bridging the Generations" presented the thoughts of several seasoned forensic science professionals on the topic of generations and how they perceived the newer generations' views on things like professionalism, work ethic and mentoring, to name a few. As a follow up to the article, the same group got on the Fall Seminar schedule as a panel to further clarify their thoughts and elicit a response from the attendees.

When I read the article, before submitting it for publication in the *CACNews*, I assumed it would disturb and possibly anger many of our members and cause them to respond. In my editorial, I challenged those of the generations being discussed to put their thoughts, concerns and rebuttals in writing for inclusion in this current issue. Unfortunately, I received nothing. I was disappointed in the lack of response and began thinking that maybe the participants of the Proceedings of Dinner were, after all, right in their beliefs. I didn't want to believe the newer generations really didn't care what the seasoned professionals thought or that criminalistics was not a profession but just a job (yes, I know I am oversimplifying what they said), but to my ears and email box, the membership was silent.

At the board of directors meeting immediately prior to the seminar I was pleasantly surprised to hear the membership was moved to discussion about the issue. Several board members shared with me the fact that people were upset by what was written and several discussions about the topic had occurred in their laboratories. My faith in the passion of the current generations was restored. Unfortunately, it was also brought to my attention the reason I did not receive feedback for publishing in the *CACNews* was the concern most members have for putting their thoughts on the issue in writing. I believe the concerns included possible negative response from their supervision and management or some of their peers. Though I can understand the reluctance to respond via this avenue, it is unfortunate. To be totally candid, I, too, would not have responded if an issue like this were raised while I was actively employed and focused on my career. Keep in mind, although we will not publish anonymous letters, we will withhold the name of a writer if requested.

I was also pleased by the comments and audience reaction during the panel discussion on the topic of generations at the seminar. Several people in attendance expressed their views and panel members had an opportunity to clarify and expand on items discussed in the Proceedings of Dinner. Though I understand many people are still unhappy with how their generations are (or were) perceived, open discussion is valuable and should not be avoided.

* * *

I am writing this editorial in a hotel room in Gaithersburg Maryland. The National Institute of Standards and Technology (NIST) is holding what I believe is their second forensic science symposium. As described by NIST, the purpose of Forensics@NIST 2012 is "This three-day symposium will showcase cutting edge forensic science research being performed at NIST. Attendees will learn how NIST's

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Greg Matheson
CAC Editorial Secretary

world-class laboratories and staff support many forensic science disciplines. See how material scientists, metrologists, analytical chemists, biological scientists, computer scientists, and forensic science practitioners work together to address the challenges facing the forensic science community and where NIST is going next."

I think my first exposure to NIST was when I was assigned to run the LAPD Finnegan model 3000 and 4000 mass spectrometers in the early 1980's. The 4000 had an advanced data system which included the ability to search the NIST mass spectra database to help identify unknown compounds. NIST then fell off my radar screen until about 10 years later when I had the opportunity to take a DNA class in Denver Colorado. In the class were three scientists from NIST who wanted to learn about how DNA was used in a crime lab and to see what role NIST might have in the process. I couldn't figure out why NIST would have a role in forensic science, but their representatives at the training were very nice and knowledgeable. Fast-forward 20 years and NIST has become a major player in forensic science research and an integral part of federal legislative proposals, which will impact the future of forensic science service delivery in the United States. It is due to their increasing presence in forensic science and the desire to connect with many people I know at NIST that caused me to trek across the country to attend their symposium. It was worth every penny spent and I encourage everyone to look out for Forensics@NIST 2013 and plan on attending. The work they perform is impressive.

To close out this issue's editorial secretary soapbox, I thank everyone across the country who read the on-line version of the *CACNews*. A couple of people approached me here at the NIST Symposium to tell me they regularly read and enjoyed the *CACNews*. I have heard this several times before. I get comments like this regularly while attending forensic science events outside of California. It says something about our association and membership when both members and non-members alike follow a regional newsletter. Let us keep the *CACNews* an outstanding forensic science community resource by ensuring you, our readers, (members and non-members of the CAC) continue to submit high quality papers and other interesting information. It would be great to hear from some of our distant followers. You are encouraged to send me a Letter to the Editor sharing your thoughts about the *CACNews* in general or an individual article in particular. Also, a big thank you to John Houde who always locates interesting content and assembles it in an outstanding format.

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FEEDBACK

Peter DeForest on George F. Sensabaugh

I felt privileged to have been present at the most recent meeting of the California Association of Criminalists in San Jose for the Founder's Lecture delivered by Dr. George F. Sensabaugh and for the wonderful tribute to George in recognition of his recent retirement from the UC Berkeley faculty, which took place at the banquet. The lecture and tribute were the primary reasons I was in San Jose for the CAC meeting.

see FEEDBACK on next page

Student Poster Sessions at the Fall Seminar



(top) Alex Huang, UC Davis, displays his poster titled, "Recovery of Male DNA Deposited on Female Skin after Oral Contact." (Co-authors Ballard, Green and Panacek.) Above, Dipiti Patel (left) and Desiree Mumford, CSU Sacramento, show their poster on "Serological Detection and DNA Recovery from Blood Stains Exposed to Four Common Household Water Conditions." (co-author R. Ballard)

Every speaker at the tribute spoke of some combination of George's awesome and endearing attributes . . . It was clearly evident that all of the speakers had a sincere and deep admiration for George. . . . I sat at the same table with George at the banquet and noted that he really enjoyed these.

Knowing that I would be attending, I arranged with Steve Lee to make a presentation with Greg Matheson.

I first met George a few months shy of 50 years ago when he first came to Cal fresh with an undergraduate degree in philosophy from Princeton. George and I became good friends and were contemporaries through graduate school. We were accepted as CAC members at the same meeting and we both finished our D.Crim. degrees in the early part of 1969. George completed his dissertation about four months ahead of me. George then left for England to do a post doc, and I accepted an assistant professorship at John Jay College in Manhattan, but we stayed in touch.

Every speaker at the tribute spoke of some combination of George's awesome and endearing attributes (brilliance, powerful intellect, broad knowledge, myriad contributions to the field, ability to inspire, generosity with time, and kindness, among others). It was clearly evident that all of the speakers had a sincere and deep admiration for George. Some were so emotional they had a difficult time speaking. Almost all included a humorous anecdote or two. I sat at the same table with George at the banquet and noted that he really enjoyed these. Given that, I decided to include a few of my own here.

Several of the speakers during the tribute spoke of George's "uniform" of khaki trousers and a blue Oxford cloth shirt with folded back sleeves. I recall an additional accessory that was an integral part of this outfit in the early days when we were both graduate students at Cal. George also wore a pair of deck shoes that were in dire need of repair. The front part of the sole of at least one of the shoes had separated from the upper. This loose flap of leather made a "signature" noise when George walked and served to announce his approach. Much later, as his finances improved, these shoes were retired.

Sometimes, when we were both at Cal, I would invite George to lecture to my students. As might be expected the lectures were always excellent. However, one lasting recollection of these is the image of George pacing in front of the room and chain smoking cigarettes while lecturing. Clearly, times have changed.

I recall one summer after I had been at John Jay for a few years when my wife Carol and I were in the Bay Area and Linda and George invited us over for a barbecue. In the time since we had last been together, George had developed expertise in brewing. This was undoubtedly facilitated by his background in biochemistry. He proudly showed me his production of beer and offered us some. At the end of the visit his entire production had been consumed. This one visit apparently abruptly ended George's brewing career.

I join everyone in wishing George a productive and happy retirement.

—Peter DeForest

Unfortunate Generalizations

As I was listening to the group presentation at the last CAC meeting and even more so after rereading the proceedings of Lunch/Dinner in the last *CACNews*, it struck me as unfortunate when dedicated professionals are made to feel less than they are—even if it was done solely to stimulate discussion. During the presentation at the CAC meeting, the following saying then came to mind, "Everyone is being painted with the same brush." As I reflected back on the scientists I have met during my career and as I looked around the meeting room, I would state that I have seen many Picasso's in every "generation" of forensic scientists.

—Jennifer Mihalovich

Bakersfield Host Responds

I just wanted to say thank you to President Weller and to Larry Blanton who reported most positively on the CAC Spring 2012 meeting in Bakersfield. On behalf of the Kern Regional Crime Laboratory, its seminar host committee, and myself it was an honor, privilege, and pleasure to be able to provide CAC members and forensic scientists from other jurisdictions to experience a week of quality workshops, an engaging technical session, and an unforgettable evening of fun and entertainment at the banquet held at Buck Owens' Crystal Palace. The band definitely did not disappoint.

While putting together a seminar of this type is a lot of hard work, we were heartened to learn that the attendance was good despite these hard economic times. The quality program including the number and variety of workshops were partly responsible for the good draw. Of course, it did not hurt to be able offer reasonable lodging rates with a great entertainment package. Feedback from the vendors was positive. The interaction of our members with the vendors during breaks and down time allowed for this host committee and future host committees to offer quality venues. Again, we could not accomplish this without our members' support.

It is incumbent on our members to support the semi-annual seminars by attending not only the workshops held before the general session but to attend the general session as well including the business meeting. This allows for continued quality topics and presentations and papers to be presented. Whether or not your laboratory sponsored or sponsors your attendance at this meeting or future meetings, it is your responsibility to receive continued education and training, and I cannot think of any better venue to achieve this than by attending a CAC seminar. So, I urge you to continue your support by not only attending one or both meetings offered each year but offer to present a paper either orally or by poster, sponsor a workshop if you possess an area of expertise, and by all means visit with and talk with the vendors because without them the ability of this organization to offer you a meeting of quality and variety is not be possible.

As I enter this new phase of my career called retirement, I still intend to remain fully active in the CAC, probably more so than ever. The future of forensic science as we know hangs in the balance. With federal oversight looming over its practitioners, it is evident that we as member can choose to be either proactive and vocal or merely act as bystanders who will and can only accept what is dictated to them from a nebulous central authority that may or may not have your best interest at heart. I look forward to seeing you at future CAC meetings and wish the next seminar host committee all the best.

—Greg Laskowski

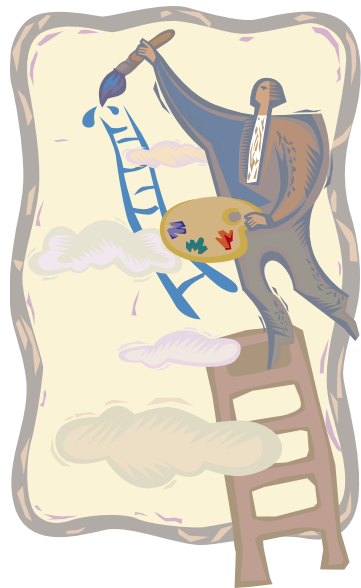
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Journey to the Red Planet: Curiosity Meets Forensic Science

We were unable to attend Greg's retirement lunch last year, but sent comments that were kindly read for us during the event. At the end of our comments, we extended an invitation to Greg to participate in a POL. He accepted, and we were finally able to make it happen during the recent CAC meeting in San Jose. We were pleased to be able to meet over an actual lunch, an occurrence that has become all too rare due to work and travel schedules. Vito's Italian restaurant provided a pleasant venue to spend a couple of hours eating and chatting.

It is always interesting to see how retirement changes the lens through which someone views their previous professional career. As Greg spent much of his professional life running one of the largest crime labs in the country, we were curious about the lessons learned and what, if anything, he might have liked to do differently. So we gave him that chance, at least in the land of fantasy. In order to begin with a completely blank palette, we asked Greg to imagine that he was being



In order to begin with a completely blank palette, we asked Greg to imagine that he was being sent to Mars to set up a new forensic laboratory completely from scratch.

sent to Mars to set up a new forensic laboratory completely from scratch. He would have full control and could have anything that he could imagine. If the idea of an extraterrestrial environment was too disconcerting, we suggested that he could also think in terms of the new lab that is being constructed from pretty close to scratch in Washington D.C.

Greg's new crime lab

Greg's first reaction was deeply reflective; this was a

difficult question, because organizations in particular tend to be reactive, rather than creative. His first concern was to ensure that the lab would be properly supported financially. His observation from long years in charge of things, and from viewing labs throughout the country, is that funding is rarely sufficient unless mandated by politicians, often in response to a scandal. The new laboratory in Washington D.C. is part of a novel experiment, consolidating public health, medical examiner and forensic labs all together under one roof, and outside the jurisdiction of a law enforcement agency. The three of us muse for a few moments about what new issues might surface under such a model. Keith recalls one lab director's concern that he would then have to compete for resources (money!) with the law enforcement agency, inasmuch as helicopters and beat officers are an easier sell than the latest MALDI-TOF instrument. In the D.C. situation, we know the director to be an at-will employee of the city, serving at the pleasure of the current mayor. This model potentially generates a completely different set of complications than the current typical system of a tenured employee. We can easily anticipate situations where the politics could trump the science, and decisions for and about the lab might be made on the basis of expediency, rather than sound forensic science principles. Greg further observed that whoever hires you enjoys the prerogative of setting casework priority. If, for example, the government decides that the war on drugs will take precedence (for perfectly legitimate reasons), then a shift of personnel to the narcotics section will be ordered, inevitably reducing the work force available to process evidence from major crimes (homicides, rapes, etc.).¹ One irony Greg experienced at LAPD was that, at the same time the number of analysts in the DNA section was tripling, everyone at the lab was also being furloughed two days a month. This serves as a reminder of the irrationality of politics.

Norah then wondered, in the theoretical construction of this lab, whether trace evidence is abandoned? Greg responded in a slightly round-about way, beginning his answer by picking up the end of the previous thought; hiring lots of people to solve a backlog crisis in DNA can have some long term benefit for the overall lab staffing and services, at least if you are a clever administrator. Once that DNA backlog is eliminated (and it will be), the government will not simply lay off those analysts. The administrator will now shift those people to other sections, including trace evidence. The simple

¹ Keith offers his version of the day worker version of crime lab staffing; every morning, the crime lab directors from all of the local agencies drive their buses into the local forensic science supply store parking lot and call out, "Today, I need 3 DNA analysts, 6 firearms examiners, and 14 drug analysts. Trace people, sorry, go home and center your substage diaphragms. Maybe tomorrow will be a luckier day for you."

Proceedings, *cont'd*

existence of personnel available to perform work has a way of creating the need for analysis; work will expand to fill the time and hands available to perform it. Once again, the rationale for the success of this strategy starts on the edge of the topic. First, Greg offers these priceless nuggets of historical data. In 1992 the LAPD lab employed almost 3 dozen analysts, a time when crime in the City of Los Angeles was at its highest level ever. Since 1993, crime has steadily decreased to a level commensurate to the 1960's (before the Timothy Leary/*Beatles*-induced drug frenzy), however his laboratory grew to about 150 analysts. Hence, he concludes, lab staffing is not connected to the crime rate. Instead, it relates to how the judicial system (detectives and attorneys of all persuasions) is using lab services. Thus, if you create the service, the requests will follow. His proof of that came when the LAPD civilianized the firearms section. The story went like this: The Firearms Analysis Unit, which was composed of predominantly sworn analysts, experienced a confidence crisis due to a misidentification. An audit was performed and it was decided that the analyst positions would be civilianized. During the training of civilian criminalists, independent contractors were hired to complete casework. The utilization of outside contractors and the eventual phasing in of civilian criminalists increased productivity, quality and confidence in the unit, which resulted in a significant increase in requests for analysis.

Forensic science and economics – strange bedfellows

A portion of this meandering discussion considered the economic expectations of forensic science services. For example, should they be expected to justify their own existence, to be completely self-supporting, or should the social value of the services be considered in determining whether they should be subsidized in some fashion? Greg suggested that some types of services might be offered more economically by privatized laboratories, but it wouldn't make political sense. As an example, he indicated that LAPD spent \$8 to \$10 million to eliminate the backlog of unanalyzed sexual assault kits. It was anticipated that the elimination of the backlog would enhance and increase new rape prosecutions. Ultimately the backlog elimination program resulted in fewer than 10 new rape prosecutions from that funding. Now, \$2M per case doesn't seem very cost effective, EXCEPT to the 5-10 people whose cases were solved (and all of the ancillary people whose lives were also affected). Norah has long maintained that forensic science is not a business; it's a profession. Especially for laboratories, which require capital expenditures (not just person-hours) to operate, it is almost impossible to make ends meet just doing casework; economically successful private laboratories almost always have some additional mechanism to generate positive cash flow that supports the casework section of the lab. Keith suggests that, ideally, society should view forensic science as an investment in justice, from which no return is expected except for better justice. This, of course, is hard to quantify. Efficiency could certainly be improved, but this, in and of itself, requires some investment of resources. Greg recalls a presentation at a professional seminar that placed the socio-economic impact of a homicide at about \$800,000. This implies that there exists a much broader impact to solving a homicide than merely the number of dollars spent on the lab work. We conclude, in our pasta-fueled sense of importance, that any crime lab investment is inexpensive compared to the benefit accrued from improved justice. We offer as Exhibit A the demise (privatization) of the Forensic Science Service in

The next question that we pose to Greg is, who has access to the lab?

the UK; it took a bit longer than a year for the first disasters to emerge.² We observe that when analyses are driven by economics, corners are cut, compromising analyses. Greg relates a tale told him by a former FSS analyst who had responded to a crime scene. The chap (he's British, after all) related that the scene was bigger than originally thought, and the forensic expert had to call the agency and break the news that this scene work was going to cost much more than originally quoted, because the job was bigger. And the hiring agency then had to decide whether to expend the funds or not. At least at our table, we agree that this is just silly.

Somewhat surprisingly, however, Greg offered that, on the whole, he would prefer, IF properly supported, for his new lab to be located outside of law enforcement. But, he emphasized, that's a big "if" (note how we cleverly capitalized that word in the previous sentence, making it, indeed, a big "if"). With proper resources, he believes that having an independent lab would enjoy the added benefit of improved perception and reputation of the lab. But he leaves open as a different question whether the lab would actually **be** better.

Organization of the laboratory

The next question that we pose to Greg is, who has access to the lab? The question was intended to elicit some comments about prosecution and defense, but Greg takes it in a different direction. Here he makes a wonderful suggestion, to divide the lab into an investigative arm and an analytical arm. In his world, he has always struggled with providing two kinds of forensic science services: one is a service that provides timely investigative leads, requiring a rapid turn around time and close communication with agent; the other is a more reflective, complex and often lengthy analytical service whose goal is admission of analyzed physical evidence into litigation.

Keith responds by observing that the certainty requirements for these two functions are different. If properly understood by the investigator (another big "if"), providing a 60% certainty on a fingerprint is a perfectly legitimate clue, no different than any other lead gleaned, for example, from an eyewitness account. The detective can use this information to go investigate an individual, knowing that some uncertainly exists in the information. Certainly, these types of leads are provided in the current system, including, for example, a NIBIN hit in firearms before confirmation, as well as narcotics field tests. Perhaps the difference is that these leads point to objects rather than people (as would a fingerprint or DNA profile), but that is another discussion.

The upshot is that Greg would create a portion of his new lab that would directly interface with law enforcement agencies to provide investigative information quickly. The second core of his lab would provide a deeper analytical processing of the physical evidence, but, in contrast to current dogma, one that involved the police, the prosecution, and the defense, all providing input into what scenarios are tested, and therefore what evidence is analyzed, and which analyses are performed.

² Privatisation is a catastrophe, warns godfather of forensics; Abolition of Forensic Science Service has led to miscarriages of justice, says DNA pioneer. <http://www.independent.co.uk/news/uk/crime/privatisation-is-a-catastrophe-warns-godfather-of-forensics-7606789.html>

So now, we say, your brand-spanking-new lab is funded, built, equipped, manned and womanned, and protocols are in place; how do you train your analysts into top flight workers? Greg is quick with a quip; steal all the good people from other labs!

Keith notes that with this new organization, trust is an essential ingredient for success—all participants need to believe that the evidence will be examined with the best interests of justice in mind. Greg follows this by saying that no decent detective wants to waste time following the wrong track. We agree that if all interests are represented and involved at the beginning of the laboratory process, the less likely it is that the process will be derailed during the litigation phase of the judicial process. Greg further opines that this construction could be laid out in such a way as to eliminate the inherent bias incurred by attending the crime scene and participating in its processing and the collection of evidence; the “judicial” laboratory analysts could be insulated from that by entering the process later, when all interested parties were now engaged.

One problem that Greg identifies, is that for small samples, an insufficient amount of evidence would be available to run two tests, one by the investigative lab and one by the judicial lab. Keith counters that for many types of evidence (DNA comes to mind), the difficulty arises in the interpretation, not the actual consumption of the evidence itself. In those cases, the data typically exists in a form such that subsequent analysts can examine it with a sequentially unmasked routine, minimizing the likelihood of biased interpretation. In such cases, the benefits of both laboratories are retained. The stickier question comes when the evidence is consumed solely by its collection, or by preliminary or presumptive test very early in the process. In such situations, decisions by the initial analysts become irrevocable, and anyone reviewing the evidence subsequently is completely reliant on both the judgment and documentation of those examiners.. Alas, no system is perfect.

In the end, then, Greg would divide his lab into the investigative and the judicial. This seems to us like an experiment worth funding (NIJ, are you listening?).

Reports and testimony

The next question that we pose is, what does the work product of your lab look like? Greg’s answer starts with, well, they would look the same as they do now; what evidence did you get, what did you do with it, and what’s your conclusion. But we press a bit harder; would reports look the same? Ah, no, he says—they would have more information than they do now. He continues by relating the evolution of his thinking on this topic. In his early years as a criminalist he believed that we just needed to express our final conclusion. Good grief, he thought, we can’t give more information, they (attorneys) will just want to ask you more and more questions! But with greater experience, he has come to believe that more explanation in a report results in an easier time on the witness stand, because there are no surprises. In addition, many cases are resolved prior to reaching a courtroom, therefore the report should be able to stand on its own without additional testimony. Of course, every analyst should be able to answer any question related to what he did, and with any level of detail requested. Norah offers, for example, that if you find contamination in your analysis, the analytical report should disclose that, and further, the notes and corrective action should detail the steps that you took to investigate the incident and determine the source. When human errors are dealt with properly

and completely, the issue tends to go away in court, as there is nothing left to question. It’s not a bad thing that we’re human; it’s pretending we’re not that creates problems.

Part of Greg’s evolution in thinking was his reflection on documentation practices from the ‘60’s and ‘70’s. He felt that they could not prove that the analysis had been performed correctly. At the time, pressure existed to erasing a huge backlog of work, and the analysts had to choose between doing the work quickly or slowing down and dotting all of the i’s and crossing the t’s. Quickly trumped slowly, and when they discovered the problems that this decision caused, it was clear that the process had to change. He feels that the watershed moment was the very public challenge to the lab during the O.J. Simpson trial, in which they were unable to respond to assertions of incompetence or fraud, not because they had been committed, but because insufficient documentation existed to prove that they had not occurred. The value of accreditation, he believes, is that it forces you to document everything. In his imaginary lab, quality and procedure manuals are posted on the Internet for anyone to review. While this creates an ancillary problem of making sure the documents are current, it does guarantee transparency.

Training and education

So now, we say, your brand-spanking-new lab is funded, built, equipped, manned and womanned, and protocols are in place; how do you train your analysts into top flight workers? Greg is quick with a quip; steal all the good people from other labs!

He recognizes that starting a lab from scratch will take time; it might be three years before the first case gets out of the door. (In fact, this was exactly the timeline for the CA DOJ DNA lab, from inception to casework) What training, we ask, would you provide? Is training the same as professional involvement? Greg thinks that encouraging professional involvement (CAC!), including continuing education, is an essential part of doing the work, and is a legitimate part of the job. In his ideal lab setting, he would make sure to include an in-house classroom facility to emphasize the importance of continuing education. In addition, he feels that all analysts must be exposed to experts outside of the insular world of their own lab, as well as the expertise of other disciplines. It is not a new thought that broad exposure to the wide world of criminalistics disciplines is an essential part of his analyst’s education; the challenge comes with accomplishing that in the milieu that surrounds the ever-increasing specialization that is forensic science today. Nevertheless, it is critical for analysts in all disciplines to be aware of the wide variety of material that can be evidence, and how to recognize and preserve it. He returns to this later during a discussion of mentoring.

We then ask Greg if he has ever taken the opportunity to reflect on the best split of time between casework and professional development (e.g. training, and education)? With a laugh, he responds that he’s thought a lot about it, but never reached a satisfying conclusion. When we ask him to make it personal, he responds that over the course of his professional career, he would typically spend about 10% of his time on independent study or attending conferences. Norah relates that

Proceedings, *cont'd*

she spends closer to 30-50% of her time on various educational and professional development activities. John Thornton once told Keith that every case presents the opportunity to pursue some bit of research that would optimize the analysis. This reflection, if accepted, would require a paradigm shift about how cases are worked.

We turn then to the role of the analyst and her approach to casework. Considering major cases only, Greg says that in a perfect world (and we keep reminding him that this is a world of our construction, so for the moment it is a perfect world) every criminalist has a background and expertise sufficient to sit down with a detective, speak intelligently about the case, and assist the detective in understanding which items of evidence will help solve the questions they both agree are important to the case. Given our earlier discussion about the two parts of his laboratory, we assume that this role would be performed by analysts in the investigative section, and that he also means to include the prosecuting and defense attorneys during the phase of the work performed in the judicial lab. Because analysts do not begin with such wide ranging expertise, we ask whether Greg's lab would include a mentoring program? That, he says, is the best way to acquire the context of the job. And how, then, would mentoring work? By having the right personalities and expertise involved, he responds.

Case review

The conversation then veers into reviewing and evaluating a case. Norah comments that performing a review of someone else's work is incredibly valuable, as you see how other individuals perceive and address a problem or issue. It forces critical thinking in a way that reviewing your lab-mates's case never can. She offers that every analyst should experience performing independent review, ideally for opposing counsel, but at least across laboratory systems. Reviewing work from another laboratory which uses a different workflow or presents the information different way forces the analyst to look with fresh eyes, and it prevents one from becoming insular. Another possibility that she suggests is sending the same case material to several different labs for review and, ultimately, discussion. Among other benefits, everyone is encouraged to remain open to a different interpretation, and comfort is discouraged. Keith believes that the appropriate attitude for a reviewer is, "If there's a mistake, I want to find it, and if I make one, I want you to find it." We owe it to each other and to the administration of justice to find and correct errors.

We'd like to conclude by leaving you with the blueprint, both physical and metaphorical for "Greg's new lab." But in spite of talking for over two hours, and covering many more topics in both exquisite and excruciating detail than presented here, we've barely made a start. However, we are convinced that if even the rudiments of Greg's lab were adopted, we will have made progress in creating an environment best suited for the competent and ethical practice of forensic science.

Denouement

We can't leave this POL without a plug for Aero Quartet movie repair service (aeroquartet.com) who saved our collective rear ends by repairing the corrupted audio recording of this discussion in record time (in spite of beaming to Barcelona and back!) and for a very reasonable fee.

The Wisdom of Crowds by James Surowiecki

Book Review by Bob Blackledge

Does this book contain any *Wisdom* for criminalists?

Before checking this book out from the library I felt I already had a general idea of what it was about. Way back in the early seventies I had attended a five-day course on crime lab management held in Quantico. I still vividly recall one of the exercises from that class. The premise was that we (the class members) were astronauts and our space ship had crash-landed on the Moon. No outside assistance available, and to survive we would have to make a trek of several kilometers across the surface to where a permanent ground facility was located. Each of us was given identical lists of items aboard our craft that were available that

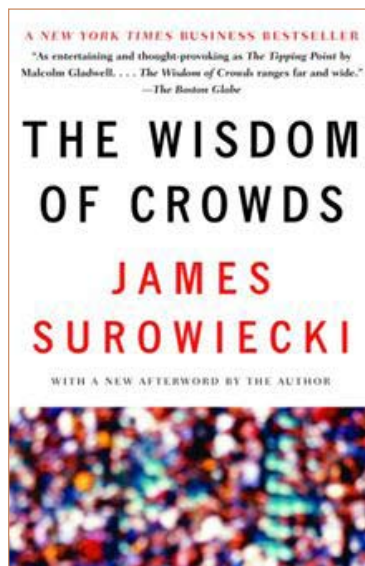
we could take on our trek to assist us. Of course, it would be impossible for us to take everything. So first, on a completely individual basis we were to rank order the items on the list with the first being the most vital and then in descending order until the last would be the item we least needed. After each of us had completed our own lists, we were then put into teams of about five or six per team. The team members were to compare the pros and cons of the possible choices and come up with a consensus list for the entire team.

I have always had disdain for committees. I hate to attend compulsory meetings. The same people say essentially the same things over and over as though they could somehow convince the group if they just said it enough times. Meanwhile I sit there wanting to scream as my precious time on the Blue planet ebbs away. And yes, I've always agreed with the old bromide, "A camel is a horse put together by a committee."

So you can imagine my surprise when it turned out that not only with my group, but with every group the group score was ranked higher (better) than that of any individual in that group! (The optimum order had been decided upon by a large group at NASA.) So from that lesson as well as things like the continued failures in the Soviet Union of their five-year plans, I got the idea that the assessment of groups (and the larger the better) would provide a more accurate assessment than that of any individual (no matter how well-qualified) or even that of some small group of specialists in that area.

James Surowiecki's book (he largely reports on the research of others) not only does not refute any of the above, it goes way, way beyond it! In what follows don't get mad at me (actually, I couldn't care less). I'm just the messenger.

To put it very succinctly, Surowiecki reports that not only is the wisdom of crowds superior to that of any individual no



At first I was incredulous. How could a diverse group come up with a better solution to a problem than a “Blue Ribbon Panel” of experts?

matter how well-qualified, but the wisdom of a large, diverse group is better than that of a panel of experts. The definition of “diversity” is very important. Although Surowiecki may be perfectly happy with groups comprised of individuals having a wide variety of ethnic backgrounds, that is not what he means by “diversity.” No, by diversity he means a wide variety of educational backgrounds, economic, religious, political, age, occupation, sex, geographical (urban, rural), —I could go on. In other words, as varied as possible.

Quoting from page 33, “...a series of studies that have found experts’ judgments to be neither consistent with the judgments of other experts in the field nor internally consistent. For instance, the between-expert agreement in a host of fields, including stock picking, livestock judging, and clinical psychology is below 50 percent, meaning that experts are as likely to disagree as to agree. More disconcertingly, one study found that the internal consistency of medical pathologists’ judgments was just 0.5, meaning that a pathologist presented with the same evidence would, half the time, offer a different opinion.”

Hmmm, I guess that explains a lot about the testimony of the expert witnesses in the Lana Clarkson murder trial (Phil Spector, defendant).

At first I was incredulous. How could a diverse group come up with a better solution to a problem than a “Blue Ribbon Panel” of experts? In World War II could a large diverse group have designed, manufactured, and tested an atomic bomb more quickly and come up with a version superior to that produced by the eggheads in the Manhattan Project? Or could such a large diverse group have come up with a method of ending the war with Japan that didn’t require either the employment of an atomic bomb or the invasion of the Japanese home islands?

Somehow my mind always turns to the question: “Could this have any relevance to forensic science, or to criminalistics?” The American Society of Crime Laboratory Directors (ASCLD) has been around since 1973. When I think about the people of ASCLD, I’m reminded of an old joke from my teaching days.

An avid hunter had saved up money so he could fly up to a hunting lodge in Alaska. The day of his arrival he told the proprietor that he wanted to hire the best hunting dog available. The proprietor replied, “I have just the dog you need, we call him ‘Instructor’ because he can teach the other dogs quite a few things.” Well the hunter bagged his limit and could not have been more pleased. It was a few years before the hunter had saved up enough to return, but when he did he asked for ‘Instructor.’ The proprietor said, “That dog has improved so much that we changed his name to ‘Professor.’ However, I’m afraid we’ve had to raise his cost/day.” The hunter said, “I don’t care; that’s the dog I want.” This time the hunter had even better results than the first time. Well, it was a number of years before the hunter was again able to return. But when he finally returned he asked the proprietor if he could again have the dog named ‘Professor.’ The proprietor said “Sure, but

his name is no longer ‘Professor’, we now call him ‘Dean.’ The hunter shrugged and said “Okay, well I guess he costs more per day than last time.” The proprietor replied, “Oh no, you can have him for just a dollar a day.” The hunter was incredulous and asked ‘why?’ The proprietor replied “Well, now that he’s a ‘Dean’, all day long he just sits on his haunches and howls!”

So, in terms of the lessons in the book, no real surprises. Not only are the members of ASCLD not a very diverse group, but for many it has been years since they helped process a crime scene or work a case. Early on in their careers they declined a career path leading to their becoming a specialist in any of the criminalistics sub-disciplines. No, they kept their eye on the prize and advanced up the ranks.

But what about groups that are comprised of the very best and most-respected experts in their field? For example, what about all the different Technical Working Groups (TWGs) and/or Scientific Working Groups (SWGs)? According to *The Wisdom of Crowds*, better decisions would be made by a group comprised of some experts but also having others of more varied educations and backgrounds. So I asked myself, “Does that jive with my past experience?” Musing on this, at www.inc.com/jessica-stillman/fly-first-class-over-economy-coach-business.html?nav=pop I came across: “My most interesting networking realization is that in 30 years in international business, I have yet to meet anyone personally or professionally interesting in first class. However, nearly every time I fly economy on a miserable, long flight, I am seated with someone who proves to be an interesting person and from whom I can learn something. Inspiration does not come in first class or from a consultant with an M.B.A.!”

I’m not good at networking, but by far most of my ideas (good and bad) have not come as a result of my talking with colleagues or reading articles in forensic science journals. I immediately thought of my most recent example. A friend who is a fire inspector had invited me to a pancake breakfast hosted by a local fire house. After I went through the line and got my food, my friend motioned me over to a seat at a nearby table. My friend introduced me to a friend of his who was sitting opposite. In the ensuing conversation I learned that he was a retired airline pilot and that he was now an entrepreneur. He (the retired pilot) talked about some of his ideas related to fire investigation. His comments immediately triggered in me an idea related to criminalistics. I thought to myself, “Surely someone else in forensic science has previously come up with this idea and researched it.” As soon as I returned home I got on my computer and did a Google search. Not a single hit came up for the term for this technology and “forensic science.” TWGs and SWGs stick with the tried and true (*validated protocols?*) and seldom come up with anything novel.

This would also be true of committees that select the oral presentations and posters to be presented at various forensic science meetings (the CAC is so desperate for speakers that they’ve never turned me down!). For example, let’s consider the program the committee came up with for the NIJ/FBI-sponsored Trace Evidence Seminar held in August, 2011 in Kansas City. I had submitted an abstract for a talk that would have told how x-ray photoelectron spectroscopy (XPS) was able to distinguish between single cotton fibers that were alike in all respects except for the presence or absence of extremely thin surface modification layers. The committee turned this presentation down. One reason they gave me was this instrumentation was not found in any forensic laboratories (not even the FBI’s) and so the attendees would have little

Blackledge, *cont'd*

interest in it. [In the early 1970's you could have gotten the same reasoning for a paper related to identifying drugs via GC/MS, and in the early 1980's for methods involving FT-IR. (DNA dudes, how in the world did Brian Culliford or Alec Jeffries manage to get their research presented?)

So what kind of oral presentations did the committee approve? One was a study on glitter. Even the title borrowed from my presentation (without attribution) at the 2007 Trace Evidence Symposium as well as the related paper I had to submit and that is readily available on the Internet. Don't believe me? Go to: www.nij.gov/events/trace-evidence-symposium/ On the right see Past Symposia and click on 2007 Trace Evidence Symposium

From there scroll down to the heading Cosmetics/Glitter and below my name click on PDF. Note just after the statement of the problem, the heading: II. What are the properties of the ideal contact trace?

Now go back to the original website and click on 2011 Trace Evidence Symposium. Click on "Download the Full Agenda PDF" From there scroll down almost to the bottom, to the last session of Day 3, Non-Conventional Trace Evidence. See the title of the presentation at 3:45 pm? Presumably the Program Committee was familiar with what had been presented in 2007 and the papers that were available on the Trace Evidence Symposium website, but they preferred the "tried and true" over something new.

Oh, and speaking of the NIJ, what about the composition of the secret panels that review grant proposals for research in forensic science? Page 28: One key to this approach is a system that encourages, and funds, speculative ideas even though they have only slim possibilities of success. Even more important, though, is diversity—not in a sociological sense, but rather in a conceptual and cognitive sense.

Okay, let's move on to the big question of the day: The NAS Committee Report, Strengthening Forensic Science in the United States: A Path Forward. How good a job was done in selecting the committee that produced this report? I count just 17 members. What are their backgrounds? I count two criminalists who are now in the forensic science education dodge, two medical examiners (one is retired—I'm mollified that at least there is one "geezer"), a director of a crime laboratory system, and the rest are an assortment of judges, attorneys, experts on statistics, and university professors in a variety of scientific specialties. On the positive side at least they are not all forensic scientists. There is some diversity. But notice that there is no one from the private sector. There is one private attorney, but in one way or the other all the rest either are or have in the past enjoyed the largesse of government employment. With this make up it would have been really surprising if the committee had come out with a recommendation of closure of all government (Federal, state, county, municipal) forensic laboratories. But notice the absence on the committee of anyone like "Joe the Plumber." This is a highly educated group. I don't know their ethnic composition, but I see no one who earns a living working with their hands, or who is likely to be on food stamps.

I can't speak for James Surowiecki, but I can quote from page 29 of his book:

"Generating a diverse set of possible solutions isn't enough. The crowd also has to be able to distinguish the good solutions from the bad. We've already seen that groups seem to do a good job of making such distinctions. But does diversity matter to the group? In other words, once you've come up with

a diverse set of possible solutions, does having a diverse group of decision makers make a difference?

"It does, in two ways. Diversity helps because it actually adds perspectives that would otherwise be absent and because it takes away, or at least weakens, some of the destructive characteristics of group decision making. Fostering diversity is actually more important in small groups and informal organizations than in the kinds of larger collectives—like markets or electorates—that we've already talked about for a simple reason: the sheer size of most markets, coupled with the fact that anyone with money can enter them (you don't need to be admitted or hired), means that a certain level of diversity is almost guaranteed.

"...found was that a group made up of some smart agents and some not-so-smart agents almost always did better than a group made up of just smart agents. (pg 30)

"...much of what we've seen so far suggests that a large group of diverse individuals will come up with better and more robust forecasts and make more intelligent decisions than even the most skilled "decision maker." (pg 32)

Whenever some pompous ass proclaims "there are no stupid questions," I immediately strive to control my gag reflex. However, it is often the "stupid question" that gets a discussion started and leads group members to even question their basic assumptions.

Returning to my original question: "Does this book contain any wisdom for criminalists?" I think it does, but perhaps my focus was too narrow. Years ago at a CAC Seminar in Napa I gave a talk about a different way of thinking (using the ideas from the book, *The Six Thinking Hats*). I had hoped that in some small way my talk would act as a catalyst so that with every major criminal case prior to closing the case or going to trial there would be a case review with this type of thinking and every assumption questioned and alternate theories examined. That hasn't happened but I still think it should. And the composition of the group involved in a case review should be as diverse as possible. Perhaps it is its very diversity that makes our jury system work as well as it does. After reading *The Wisdom of Crowds*, were I to be a defendant in a criminal trial, whether I was guilty or innocent, the last thing I would want would be a non-jury trial!



Fractals & Fingerprints Make Me Fractious

Essay by Bob Blackledge

Even before the NAS Committee Report, many areas of forensic science were under attack. Especially prominent was the argument that there was no scientific basis for the claim that no two fingerprints were alike. Many years before reading *The Wisdom of Crowds* I had come to the conclusion that fingerprints could not be put on a scientific basis by latent print examiners, but would require the input of mathematicians, statisticians, physicists, biologists, etc.

On my own I even came up with a new metric, rate of ridge curvature. I forwarded my ideas to the FBI and was completely stonewalled.

It was Pasteur who said, "Chance favors the prepared mind." I can trace the genesis of an idea back to a book that several years ago I "tried" to read. The book was *A New Kind of Science* by Stephen Wolfram. Wolfram is a mathematical genius and his company puts out the *Mathematica* software used today by just about all serious scientists. Although a genius, Wolfram is a terrible writer. I only made it a third of the way through his book before giving up. However, in just that third I came away with Wolfram's idea that from a very simple mathematical formula or minor modification of such a formula can develop great complexity. The book shows page after page of illustrations generated by fractals whose origin was from a quite simple mathematical series. If you look at the end result without knowing the simple formula that generated it, one would logically think that it could only arise from something that was very complex.

Then more recently a friend recommended the book, *The Singularity Is Near*, by Ray Kurzweil. I was reading it while sitting in a doctor's office waiting room. I came to page 46 and a section with the heading, "Fractal Designs." I'll quote the first paragraph directly:

"A key question concerning the information content of biological systems is how it is possible for the genome, which contains comparatively little information, to produce a system such as a human, which is vastly more complex than the genetic information that describes it. One way of understanding this is to view the designs of biology as "probalistic fractals." A deterministic fractal is a design in which a single design element (called the "initiator") is replaced with multiple elements (together called the "generator"). In a second iteration of fractal expression, each element in the generator itself be-

comes an initiator and is replaced with the elements of the generator (scaled to the smaller size of the second-generation initiators). This process is repeated many times, with each newly created element of a generator becoming an initiator and being replaced with a new scaled generator. Each new generation of fractal expansion adds apparent complexity but requires no additional design information. **A probalistic fractal adds the element of uncertainty.** Whereas a deterministic fractal will look the same every time it is rendered, **a probalistic fractal will look different each time, although with similar characteristics.** In a probalistic fractal, the probability of each generator element being applied is less than 1. In this way, the resulting designs have a more organic appearance. Probalistic fractals are used in graphics programs to generate realistic-looking images of mountains, clouds, seashores, foliage, and other organic scenes. A key aspect of the probalistic fractal is that it enables the generation of a great deal of apparent complexity, including extensive varying detail, from a relatively small amount of design information. Biology uses this same principle. Genes supply the design information, but the detail in an organism is vastly greater than the genetic information."

When I read the above it was like I had an epiphany! At the stage of fetus development where fingerprints are starting to form, it is as though the genetic program is a (or a series of) probalistic fractals. Just as with their use in graphics, the end result at first generally looks pretty much the same (loops, whorls, arches with various types of ridge detail), but just as with the mountains, clouds, seashores, foliage, etc. used in graphics programs, once you examine the minutia you see that they are all different!

It was an interesting idea, but I didn't have the background (or the smarts) to pursue it. Then recently I came across an article having to do with the saguaro cactus [go to bit-player.org/category/uncategorized and scroll down ~3/4]. The article was about the saguaros' rib patterns. I was immediately struck by the similarity of rib pattern development and the development of fingerprints in a fetus.

Well, doing a Google search I quickly found I was not the first to notice this similarity:

"UA Mathematicians Predict Patterns in Fingerprints, Cacti." in *UA News.org* by Kara Rogers, March 31, 2004. [see www.fractal.org/ or go to the article directly at: uanews.org/node/9414]

"How Nature's Patterns Form," by Mari N. Jensen, College of Science, February 18, 2011. [www.uanews.org/node/37978] Alan Newell, a UA mathematics professor, studies patterns in nature, which he said have features that are universal.

See also, "Regents' Professor Alan Newell Finds Order in Chaos" by *UA News Services*, April 9, 2004.

[uanews.org/story/regents-professor-alan-newell-finds-order-chaos]

Prof. Newell's website: math.arizona.edu/~anewell/

Kücken, Michael, and Newell, Alan C., "Fingerprint formation," *J. Theoretical Biology*, 235 (2005) 71-83.

And, no surprise, Prof. Newell is neither a forensic scientist nor a latent print examiner. Is he used as an expert witness or are his publications cited when the scientific basis of fingerprints is attacked in court? A Google search came up with no hits.



Spine-crested ridges in a saguaro cactus.
From bit-player.org/2009/03 Used with permission.



Ethical Dilemmas

DISCUSSION CORNER WITH CAROLYN GANNETT

WHO NEEDS YOUR STUPID ASSOCIATION, ANYWAY?

...without a resignation policy that alerts the public, an ethics code has no teeth. It becomes no more than a voluntary guideline...

THE SCENARIO:

In an attempt to avoid being held ethically accountable, a member resigns from a forensic science association in the middle of being investigated by that association for unethical conduct.

- A. What is the CAC's policy on such a resignation?
- B. What are some other associations' policies?
- C. Is there a better way to enforce ethics?

What is the CAC's Policy on Such a Resignation?

The CAC invokes an "Order of Exclusion" (see *Code of Ethics Enforcement Policy II.B.3*). In short, the president issues an Order of Exclusion, which bars the accused from membership in the CAC. The investigation is halted, and the Ethics Committee submits an interim report of their investigation. If the accused is reinstated to membership (requiring a 75% vote of the Board), the investigation picks up from where it left off.

Here's the clincher: the president announces issuance of the Order at a CAC Business Meeting and includes the name of the accused. Business Meeting minutes are public record. So, if a member resigns while under investigation a public record of that fact is created. That record can be, and has been, used in a court of law.

So, even though the association would be unable to internally resolve an ethics complaint, the accused may still have to answer in a court of law to the fact that a complaint was issued and considered worthy of investigation by the CAC.

How effective is this? No one really knows. There is no system in place to notify the justice system that an Order of Exclusion has been issued. Attorneys have to find out about it by word of mouth—not very effective. Even if the information winds up being presented in a court of law, the accused could turn around and state that it was the CAC that was unethical in launching an investigation. The accused could further state that that is the reason the accused resigned—the CAC is just too unethical for the accused to want to be associated with it. Now we have a he-said-she-said situation. It is up to the court to determine who to believe, or whether to dismiss the matter altogether. Again, not very effective.

But, at least the policy provides a means of notifying the public.

Share your thoughts and dilemmas at
www.ethicsforum.cacnews.org

What Are Some Other Associations' Policies?

Most associations drop the investigation without notice to the public. There may be variations in housekeeping chores: what to do with the investigation materials (archive them, shred them, etc.); noting the situation in the accused's membership file, etc.

But, without a resignation policy that alerts the public, an ethics code has no teeth. It becomes no more than a voluntary guideline, meaning that one of the primary functions of an enforced ethics code—ensuring the public and the justice system of the quality of service—cannot be achieved. Because there is no requirement to belong to an association in order to practice, there would be no fallout from simply resigning from an association that has no resignation policy. For these associations, there are essentially no consequences to unethical conduct other than not belonging to that association.

There is at least one association that completes the investigation, regardless of the fact that the accused is no longer a member. A reason given for this is that it would result in a complete package of material that can be made available to the justice system upon request. Whereas this may help to call attention to unethical conduct, such a policy could raise serious questions such as: why is the association investigating someone who is not a member, couldn't it then initiate and complete investigations of anyone regardless of membership status, and what are the legal ramifications of such actions? According to one attorney who specializes in professional association business practices, such a policy leaves an association wide open for litigation.

Is There a Better Way to Enforce Ethics?

An ethics code enforced through a work environment may have more teeth than one enforced through an association, because the livelihood of the accused is at play. Quitting one's employment entails more difficulties than quitting an association. So, the accused may be more likely to elect to be subjected to correction, rather than going through the stress of trying to find new employment.

But, of those labs that enforce an ethics code, there is nothing to state that the same ethics code must be enforced by each (although ASLCD/LAB is leaning in that direction). Even if the same ethics code is enforced by all labs, there is nothing to guarantee that it is enforced in the same manner or to the same degree by each lab. And, of course, not all forensic science experts work for labs that enforce a code. All of this leads to a lack of consistency in the quality of the profession's work product, which does not serve the justice system well. But still, it may serve it better than using only associations to enforce ethics.

The ABC has Rules of Professional Conduct that all certificants are required to follow or else risk loss of their certification status. With one entity providing enforcement, such a system would be expected to provide consistency in the quality of the certificants' work products. But, unfortunately, that would only be the case for individuals who are certified through ABC. And, certification is not required, so that consistency across the profession is, once again, not provided.

Perhaps the NAS report's Recommendation #9 suggests a better solution: a national code of ethics enforced through mandatory certification of all forensic science practitioners. This means there would be one standard that all practitioners would be expected to adhere to. And, presumably, it would be equitably enforced by one body. It sounds good on paper. But, it remains to be seen how readily such a system can be implemented and effectively maintained. The Subcommittee

on Forensic Sciences has reportedly determined that ASCLD/LAB's Guiding Principles will be the national code of ethics. That's step one, but many questions and hurdles remain. We can only hope that ultimately a more consistent and effective system of ethics enforcement will result.

Have an ethical dilemma you'd like evaluated?
Submit a sanitized version to
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George F. SENSABAUGH

A Banquet of Honors



Mary Gibbons

Rockne Harmon

Marty Blake

Steven Lee

Rhonda Roby

Jennifer Mihalovich

Peter Barnett



Gary Sims

David DeGusta

Charles Brenner

Cassandra Calloway

Helena Wong

Jeff Sensabaugh

Mark Stolorow

Keith Inman



CACNews photo by John Houde.



(opp.) Former students and colleagues share their favorite stories. (top center) Jennifer Mihalovich prepares a gift scrapbook of memories.



*You've taught us well, George Sensabaugh
You understood the science and you knew the law
You've launched a hundred outstanding careers
And earned the respect of all of your peers*

*A mentor who's fair, who's calm, and who's wise
Who's after the truth, not some bright shiny prize
My first contact was Ed, then Becky and Sandy
It was clear knowing George was coming in handy*

*Our first cases were done with the reverse dot blot
Some samples matched and others did not
Ed wrote reports, George encouraged us all
This new PCR assay held us all in its thrall*

*From Pestinikis to Dotson, we followed his lead
Through Kelly, through Frye with all deliberate speed
He warned of Ben Grunbaum in Cal vs. Mack
With M. C.'s snafu, George still had our back*

*Of the new generation, he's trained all the best
They are his legacy; they continue his quest
We thank and salute you for all that you've done
Our system's more just and forensics' more fun*

*We owe you a lot and we wish you the best
We hope that you'll now get some well deserved rest
At the Frog and the Fiddle, we all hope to see you
Listening to Mary sing songs old and new
In the realm of the lab and its role in the law
Yes, you've taught us well, George Sensabaugh*

—Henry Ehrlich

FALL 2012 CAC SEMINAR SAN JOSE



"...there were WORKSHOPS!"

Before the technical portion of the seminar, there were WORKSHOPS!

Off-site, in-the-hotel, half-day, two-day, no fewer than nine workshops were offered at the fall CAC seminar.

Clockwise from center left: Improvised Explosive Devices, Fire Debris, Student Workshop (including interviewing techniques), Ethics for Forensic Scientists, Managing Human Factors in the Forensic Sciences, Forensic Anthropology: Excavation of Clandestine Graves—The "Pig Dig," Forensic Evidence at the International Criminal Courts, DNA workshop and The Joint Prisoner of War/Missing in Action Accounting Command.

In addition, the California Association of Crime Lab Directors





Jeff Salamat photo.

(CACLD) met in the same hotel as the CAC. While not exactly a “joint meeting” they invited interested CAC seminar attendees to participate. The additional choices of presentations made for an even richer seminar experience.

If you were one of the 120 or so who attended a workshop then you already know what fun it was. Please spread the word among your associates—members and nonmembers alike! —*pssst, Pasadena, Spring '13.*



Scenes from a WORKSHOP— *Fire Debris*

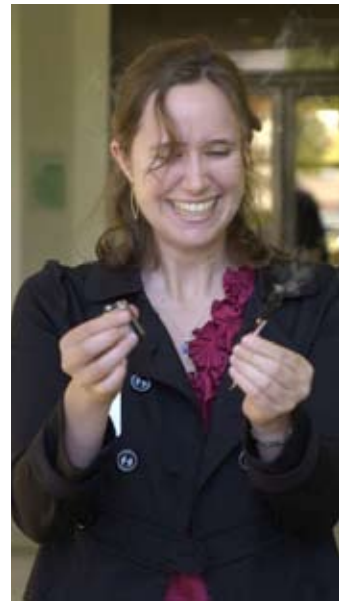


Robert Thompson photo.

Robert Thompson photo.



Scenes from a WORKSHOP— Improvised Explosive Devices



2012 CAC Founders Lecture



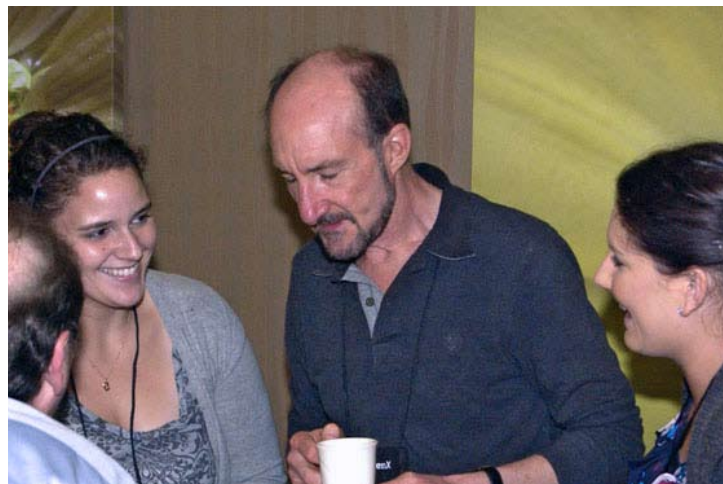
John DeHaan (standing) introduces George Sensabaugh at the 2012 Founders Lecture. Here's Dr. DeHaan's introduction:

Dr. George Sensabaugh has been a key member of the forensic profession his entire career. After getting a BA from Princeton (in Philosophy—Pre-Med) in 1963 he saw the light of his true calling and earned his D. Crim at Berkeley in 1969 (criminalistics and biochemistry) under Paul Kirk. He then completed two years as a post-doc fellow at UC-San Diego and two years at the National Institute for Medical Research, at Mill Hill in London. He became an assistant professor of forensic Science at Berkeley in 1972 and rose through the ranks of associate professor to full professor in 1986. Since 2000 he has been on the faculty of the graduate program in Forensic Science at UC Berkeley as well as serving as the chair of the Dept. of Biomedical and Environmental Health Sciences (1988-93) and associate dean of student affairs in the School of Public Health (since 2009).

Not being one to hide in the halls of Berkeley, George has been a visiting professor at the University of Strathclyde (Glasgow), University of Rome, University of the Philippines (Quezon City) and Nihon University, Tokyo).

He has been an active member of CAC since 1969 and started the first CAC Study Group (Forensic Biology) in 1974. He has been recognized for his extraordinary talents and knowledge with the CAC Distinguished Service Award, the AAFS Paul L. Kirk Award and a Fulbright Research Scholarship at the London Met Police Forensic Lab, among others.

He chaired 21 doctoral research dissertations and 10 masters theses and has published over 190 papers, notes and abstracts. An amazing series of accomplishments in addition to being a pioneer in so many forensic specialties always willing to share, teach and inspire.





Your 2012-13 CAC Board of Directors. Consider running for one of these offices—it's fun and you can make a positive impact. Clockwise from center: President Todd Wells, Treasurer Laura Silva, Regional Dir. South Mey Tann, Membership Sect'y Michelle Halsing, Regional Dir. South Meghan Mannion-Gray, Editorial Sect'y Greg Matheson, President-Elect Eric Halsing, Past President Kevin Andera and Recording Sect'y Kirsten Fraser.



Scenes from the General Session

With Steve Lee's son, Gabriel, on drums, the El Cerrito Jazz Ensemble entertains the wine and cheese reception.



General Session



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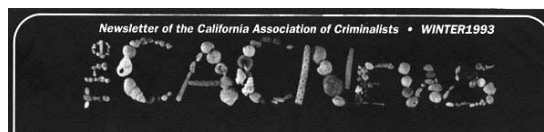
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Edwin Jones, Jr. Retires After a 37-year Forensic Career

The announcement from the Ventura SO intraweb: "Forensic Scientist Ed Jones is retiring after 29½ years of service with the Ventura County Sheriff's Office.

"Edwin L. Jones, Jr. graduated from West Virginia Wesleyan College with a bachelor's degree in chemistry in 1971. Edwin then attended the University of Pittsburgh where he graduated with a masters degree in forensic chemistry in 1974. He worked one year at the Georgia State Crime Lab in the trace evidence/firearms section and spent the next 7 years working as a one-man crime lab in the city of Fountain Valley, Calif., doing a wide range of forensic work including crime scene investigation, drug analysis, trace evidence, firearms, basic serology and miscellaneous other duties. Ed has been employed by the Ventura County Sheriff's Office Forensic Sciences Laboratory for the last 29 years in the serology/trace evidence section. That adds up to a 37-year career in forensic science. He has taught many classes at the California Criminalistics Institute. In 2005, he authored the chapter: "Identification of Semen and Other Body Fluids" in Volume 2 second edition of Richard Saferstein's *Forensic Science Handbook*. His

work on glitter in a murder case was featured in an episode of the TV series *Forensic Files*, while another homicide case involving his work on duct tape was shown on the TV series *Cold Case Files*. Ed is a lifetime fan of the Pittsburgh Steelers. He enjoys eating and therefore likes/needs to exercise. He has played lunchtime volleyball for almost 30 years. He has a sand collection from all around the world and plans on expanding that collection after retirement. —Renee Artman, Dir., Ventura Sheriff's Forensic Science Lab."



But that doesn't seem quite enough. Let me add that I owe a lot to Mr. Jones. It was my good fortune to sit across from him in the serology/trace evidence section of the lab for many years. He was my "go-to" person for a bunch of homicides, a few crime scenes and way, way too many rape-kits. I have met only a few microscopists in his league (and most of them work at McCrone Inst.) and have never met a more dedicated criminalist. Man, the taxpayers of Ventura County got their money's worth when they cut Ed's check.

One of my favorite "Edisms" that helped me get through complex and challenging cases was, "You've got to work with what you got." Sounds pretty simple, but when you're agonizing over the tiniest bit of fiber and thinking "if only I could get a bit more..."

Then there's "But does it help you get the right answer?" That's another deceptively simple expression, yet in the world of ASCLD/LAB and ISO, it is good to keep one's eye on the real reason for having a crime lab in the first place.

As civil servants we can all be replaced when we retire. But in Ventura, there is a vacancy that will never be completely filled. Good luck, my friend.

—John Houde

Above: Microfossil lettering, an Ed Jones specialty.

(left) Ed Jones in 1998 (with Yeung Kung) at the AAFS meeting in San Francisco.

(lower left) Lab Dir. Renee Artman presents Ed with several honors for his years of service.

(below) Ventura Sheriff Geoff Dean shares an amusing story about Ed at his retirement party in Sept. 2012.



Photos by John Houde for The CACNews.

FALL 2012 CAC ABSTRACTS

Advancing the Criminal Justice Response Through DNA Technology

Natasha S Alexenko, Natasha's Justice Project

Natasha Alexenko is a sexual assault survivor who was recently highlighted in HBO's critically acclaimed documentary, *Sex Crimes Unit*. In 2008, nearly 16 years after she was violently attacked at gunpoint, her perpetrator was found through a DNA match, thanks to the dedication of New York City's Cold Case Unit. Natasha's rape kit was backlogged for almost 10 years. Natasha currently serves as the spokesperson for Natasha's Justice Project—a nonprofit organization that seeks to assist survivors of sexual assault through travel grants to testify at their related trials and end the nation's current rape kit backlog crisis. Natasha speaks at colleges and other venues across the country, striving to educate and inspire through her unique story.

Single-cell Analysis and Manipulation

Dr. Nader Pourmand, Associate Professor of Biomolecular Engineering, UC Santa Cruz

Approaching sub-cellular biological problems from an engineering perspective begs for the incorporation of electronic readouts. With their high sensitivity and low invasiveness, nanotechnology-based tools hold great promise for biochemical sensing and single-cell manipulation. During my talk I will discuss the incorporation of electrical measurements into nanopipette technology and present results showing the rapid and reversible response of these subcellular sensors to different analytes such as antigens, ions and carbohydrates. In addition, I will present the development of a single-cell manipulation platform that uses a nanopipette in a scanning ion-conductive microscopy technique. We use this newly developed technology to position the nanopipette with nanoscale precision, and to inject and/or aspirate a minute amount of cytoplasmic material to and from individual cells without comprising cell viability. Furthermore, if time permits, I will show our strategy for a new, single-cell DNA/RNA sequencing technology that will potentially use nanopipette technology to analyze the minute amount of aspirated cellular material.

NIST Research Update

Dr. Michael Coble, Becky Hill, Margaret Kline, Erica Butts, Kevin Kiesler, Dr. Peter Vallone and Dr. John Butler. U.S. National Institute of Standards and Technology, Biochemical Science Division

For over twenty years, the National Institute of Standards and Technology (NIST) Applied Genetics group has developed several Standard Reference Materials (SRMs) to meet the needs of the forensic DNA community. In this presentation we will provide an update on the status of NIST SRMs, new assays/technologies, and educational resources provided to the field via funding from the National Institute of Justice.

What Happens to all of those CODIS Cold Hits?

Rock Harmon, JD., Former Sr. Dist. Atty., Alameda Co.

Since its inception, little or no effort has been made to systematically determine the outcomes for the many thousands of offender cold hits to date. This talk will discuss the few efforts that have been made to track these events, and will discuss the serious implications that flow from not having systems in place that ensure that appropriate actions are taken once CODIS matches an evidence sample to an offender.

Professionalism in Forensic Mathematics and the Mixture Dilemma (Simple Is Wrong)

Dr. Charles Brenner, DNA View

There are various mathematical problems in forensic genetics and they can most clearly and usefully be dealt with through a disciplined mathematical exposition which should be precise and logical — clear statement of the problem and of assumptions, deductive progression of ideas and justification of assumptions. Unfortunately our literature is not consistent in achieving or even aiming for such coherent mathematical standards; instead random scattershot discussions are common and even worse, recipe papers without any foundation at all.

Mixture analysis is a particularly dodgy area. "Conservative" is an often promoted byword for DNA identification calculation, generally meaning to avoid bias against a suspect. But the very nature of applied mathematics works against this goal, especially for mixtures. The inevitable problem is how to be fair to an innocent suspect, a rare bird whose existence is easy to lose sight of when the suspect fits the DNA frame. A mathematical model -- particularly in biology -- is necessarily a simplification. Simplification means omitting data. This is often touted as conferring bias in favor of the suspect and it does for most suspects. But for the most important kind of suspect, the innocent one, it does just the opposite and tends to victimize him instead.

Mixture evaluation is hard because there are potentially so many influences shaping the evidence. To try to be accurate means to adopt a complicated model but complication has obvious drawbacks such as incoherence for the court, difficulty for the analyst, and no guarantee of correctness anyway.

The holy grail of mixture computation is therefore a simplified method that will be, if not accurate, at least conservative. Enter the "exclusion method", which has been peddled as easy, understandable, and almost surely conservative. But I believe it is at best only conservative for actual contributors, and is likely to be very anti-conservative for the suspect who matters most, the accidentally included innocent suspect.

PowerPlex® Fusion: An Expanded Multiplex for New Global Standards

Yasser, Daoudi, Jeanne Bourdeau-Heller, Marty Ensenberger, Benjamin Krenke, Katie Oostdik, Cindy Sprecher, Doug Storts, Promega

As DNA databases continue to grow and international cooperation increases, the need for a common set of markers is required to facilitate data sharing and to reduce adventitious matches. Promega's

PowerPlex® Fusion System provides all of the materials needed for co-amplification and five-color fluorescent detection of 24 loci (23 STR loci and Amelogenin), including the

FALL 2012 CAC ABSTRACTS

CODIS core loci and the European Standard Set (ESS) loci. The PowerPlex® Fusion System will enable increased discriminatory power and data sharing possibilities by means of the incorporation of common and informative loci used throughout the world. In addition, the PowerPlex® Fusion System builds upon recent advances in Promega STR chemistries, including improved inhibitor resistance, faster cycling time, and direct amplification from a variety of common sample types, resulting in more meaningful analyses for both casework and databasing efforts.

The Development of Expanded “Global” Multiplexes for Human Identification Analysis

Dennis Wang, Julio Mulero, Siddhita Gopinath, Matthew Lude-man, Wilma Norona, Lisa Calandro, and Lori Hennessy Life Technologies

National DNA databases are one of the most efficient and effective tools to provide intelligence about unknown perpetrators in criminal investigations. Due to its overwhelming success in solving crimes, governments around the world have implemented an ongoing expansion of DNA databases. For examples, the European community expanded their set of standard loci in 2008 and the CODIS Core Loci Working Group have published recommendations to expand the CODIS core lociset in the United States in 2011. In addition to the DNA database expansion, countries are attempting to establish a legal basis for exchanging DNA database profiles between countries in criminal investigations.

Life Technologies is responding to these initiatives by developing a new generation of STR chemistry that incorporates as many of the loci utilized in different DNA databases as possible into a single amplification reaction. This “Global” STR multiplex is larger and more discriminating. It can reduce the likelihood of adventitious matches, increase international compatibility and improve discrimination power to assist missing person cases. The “Global” STR multiplex concept features two kits, one optimized for casework samples and the other for database applications while sharing the same configuration. The new chemistries will enable unprecedented capabilities in terms of robustness, concordance and overall ability to recover information from forensic samples. Some key features are expanded allelic ladders at certain loci to assist genotyping of rare alleles, inclusion of the DYS391 marker to provide gender confirmation in amelogenin Y-deficient males, and the addition of extra primers to reduce rare instances of false homozygosity.

The RapidHIT™ 200 Human Identification System—A Real-Time, integrated System for Automated STR Analysis

Dr. Paul Kotturi IntegenX

Since its inception in the 1980's, advances in DNA profiling have significantly reduced turnaround times, enabling DNA to play an increasingly prominent role in modern policing and civil relationship testing. However, until now, the processing time and complexity of DNA testing has limited its impact on other areas of human identification.

IntegenX has developed, trialled, and commercially launched the world's first fully integrated and automated DNA analyzer, capable of producing DNA profiles in less than 90 minutes. The RapidHIT 200 system integrates and au-

tomates the entire DNA analysis process, from sample introduction, through to analysis of results and generation of DNA profiles. The key features of the instrument will be described in layman's terms. Here we present findings from verification studies and early customer trials. The relevance of these findings with respect to use of the RapidHIT 200 system as a real-time tool for a multitude of applications such as arrestee profiling, border control, immigration, and missing/misplaced persons will be discussed, with particular emphasis on the features of the RapidHIT that enable use in non-laboratory environments and by non-scientific personnel in collaboration with DNA analysts.

Integrated Forensic Genetics Using Next Generation Sequencing by Synthesis (SBS)

Dr. Cydne Holt and Dr. Kathy Stephens, Illumina Inc.

With the advent of next-generation sequencing (NGS), the spectrum of known human genomic variation has expanded at an unprecedented rate and is resetting the amount and type of information available to investigative genetics. To-date, the vast majority of sequence data generated globally has been done utilizing Illumina sequencing by synthesis (SBS) technology. In application to forensic biology, SBS has the potential to deliver a “universal” forensic DNA panel that addresses multiple disciplines simultaneously, including criminal casework and databank, parentage testing (mass disaster, missing persons), ancestry studies, phenotyping, death investigation and metagenomics. Practical implementation of SBS in a forensic setting is enabled by the MiSeq system, which simplifies and automates the NGS process in a single system.

Results have demonstrated the potential of NGS to be used as a multipurpose genotyping platform. Studies of saliva samples have shown that autosomal STR genotypes plus their internal SNPs, Y and mtDNA haplotypes (SNPs and STRs), ancestry information, predictive visible traits as well as metagenomic data, which may serve as investigative leads, can be done in a single sequencing run. Additional markers under development include a denser set of forensically relevant SNPs and STRs on autosomes, X and Y chromosomes, and in the mitochondrial genome as well as those that are useful in molecular autopsy.

Increased discrimination power from dense, high value forensic sequencing data allows interpretation of more unknown samples that contain partially degraded and/or mixed DNA. Because NGS performs a molecule-by-molecule analysis of the contents of the original sample it is possible to view the number of observations of a given allele, and measure mixture ratios based on a count (digital) vs. a peak height (analog) result. This is expected to dramatically extend capabilities in the analysis of complex samples. The application of these technologies to forensic analysis will be presented along with data from Illumina internal labs and forensic collaborations.

‘Fingerprints Forever’ — Visualizing Fingerprint Corrosion of Metals

Dr. John Bond, University of Leicester

The visualization of fingerprints on metal surfaces after the metal has been subjected to environmental extremes is

discussed. Visualization is achieved by exploiting the natural chemical reaction that can occur between the metal surface and fingerprint sweat deposit. This reaction, effectively a corrosion of the metal surface, can result in a change to both the chemical and physical characteristics of the metal surface. We show how visualization can be achieved by various methods including optical interference, digital color mapping and electrostatic attraction. We demonstrate how fingerprints deposited on brass cartridge cases pre-firing can be visualized post-firing and examples are given from homicides where this technique has been employed. More recent application to improvised explosive devices (IED) is also discussed.

The Future of Criminalistics—Restoring Science

Peter R. De Forest, Professor Emeritus, John Jay College of Criminal Justice/ CUNY, Gregory B. Matheson, LAPD Lab Dir. (ret.)

It would not be an exaggeration to assert that criminalistics is the last, best hope for fair and effective criminal investigations. No other source of information (e.g., eyewitnesses, complainant statements, interrogation, confessions, etc.) in a criminal investigation can approach the veracity and potential effectiveness of a complete and detailed understanding of the physical evidence record. There is nothing potentially more powerful. Nothing else even comes close. Extracting information from and interpreting the physical evidence record is the job of scientists and lies within the realm of criminalistics. Sadly, although no other avenue of investigation offers more promise, this promise is not realized in practice. There are several reasons for this. For one, scientists (read criminalists) don't have oversight and control over the entire process of the recognition and extraction of information from the physical event record. Although there are no immediate solutions, and there is considerable inertia built into the system, these adverse factors or impediments need to be recognized and dealt with. Many of these cannot be directly addressed by the working criminalist. However, this is where the effort to bring about change should begin.

Well-intentioned policies and criticism by well-meaning outsiders have led to improvements in our field, but they have also contributed to impediments to the realization of the ideal. Accreditation and outside criticism premised on the misconception that forensic science laboratories are nothing more than testing facilities falls short of addressing our problems.

There is much more to criminalistics than simply testing evidence where the problem is circumscribed and defined by a nonscientist. The best case solutions don't flow from inquiries constrained in this way. Far from it.

The disparity between the potential of criminalistics and the reality in practice is frustrating for many criminalists. What should be an intellectually rewarding career can be thwarted by well-intentioned concerns that are misdirected or misapplied. Case solutions can also be adversely affected in profound ways. One example is accreditation. Accreditation has brought about many positive changes in the field, but this has not come about without unintended adverse consequences.

Bob Blackledge shared an e-mail note that he received from one criminalist. This was prompted by an e-mail that Bob sent to a CAC trace evidence group suggesting that the members might find a photomicrographic attachment to a mobile phone useful for some physical evidence documentation. He did not share the identity of the correspondent. The quote follows:

"Bob, Thanks, I will definitely take the time to check it out. Although, in light of ASCLD/LAB ISO, I would likely not be allowed to use it for anything work related because...I don't have the proper certificate of training, or its not work issued, or on a secure network, or I haven't been proficiency tested on its use....and so on! I agree there should be training and guidelines, but we seem to be able to use our brains less and less these days. Common sense isn't allowed anymore. It seems we are able to say less even with more technology."

This criminalist's concern is undoubtedly shared by others and should be disturbing to all of us. It should not be ignored. Since the correspondent is not known to us, we cannot determine whether to ascribe this view to experience with the misapplication of ASCLD/LAB ISO guidelines by laboratory management, or to perceptions on the part of the author of the e-mail note, or a combination of both.

Ideally, criminalistics is potentially one of those rare careers where one can find it to be demanding intellectually, crucially significant for society, and personally very satisfying. What can be done to restore this potential?

It is hoped that this presentation will generate considerable discussion and result in the formulation of initial plans of action.

Review of 3D Analysis in Firearm and Tool Mark Identification

Todd Weller, Oakland PD Crime Laboratory

Firearm and tool mark identification has seen a number of admissibility challenges in the past several years. The challenges include criticism that firearm and tool mark identification is not objective, is not scientific, and that the fundamental concepts have not been properly tested. Recent scientific studies that combine the capture of three-dimensional topography and mathematical analysis provide strong evidence that these critiques are wrong. This presentation will highlight some of the recent studies and how they provide objective, scientific support that the discipline of firearm and tool mark identification is on solid a foundation.

The Witness Execution of Tong Van Le

Eric Halsing, Jan Bashinski CA DOJ DNA Laboratory

In August of 2008, Tong Van Le assisted the San Francisco Police in identifying the two young men who he claimed robbed his liquor store at gunpoint. Three weeks later, on September 13, he was killed while pulling into his garage in a quiet Marin County neighborhood. A fast-paced investigation took place between the Novato and San Francisco Police Departments. On September 16, evidence began arriving at the laboratory and I was assigned to the case. In the days and months that followed, the Police and DAs Office working together with the California DOJ Bureau of Forensic Services, would piece together a case against six defendants. This talk will describe the crime, the evidence that was submitted to me for DNA testing, my results, the excellent work of the other forensic examiners involved, the trial which lasted more than six months, and the ultimate outcome of the case against the defendants.

National Science and Technology Council (NSTC) Committee Subcommittee on Forensic Science Report

Mark Stolorow, NIST

In 2009, the White House Office of Science and Technology Policy (OSTP) coordinated the establishment of a Subcommittee on Forensic (SoFS), to assess and enrich the state of forensic sciences in the United States. The purpose of the Subcommittee is to advise and assist the Committee on Science, National Science and Technology Council, and other coordination bodies of the Executive Office of the President on policies, procedures, and plans related to forensic science at the local, state and federal levels.

Over the last three years, The subcommittee's activity was organized through five interagency working groups (IWGs):

- Research, Development, Testing, and Evaluation
- Standards, Practices and Protocols
- Education, Ethics, and Terminology
- Accreditation and Certification
- Outreach and Communication

The SoFS is scheduled to sunset on December 31, 2012. This presentation will provide insight into some of the important issues that have been considered through the interagency process to include mandatory accreditation, certification, proficiency testing, terminology, AFIS interoperability, and forensic science R&D.

More than Just Standards: NIST Law Enforcement Standards Office Forensic Science Program Update

John Paul Jones II, NIST

A recent survey revealed crime laboratory management is familiar with standard reference materials produced by the National Institute of Standards and Technology (NIST), such as the Human DNA Quantitation Standard. Yet there is so much more activity taking place on the NIST campus than standards creation. The Forensic Science Program (FSP) at the Law Enforcement Standards Office (OLES) within NIST conducts and coordinates research and provides technical services to address the needs of the forensic science community. The FSP focuses on creating new material standards; initiating metrology research; evaluating technologies; and establishing expert working groups to facilitate knowledge exchange and identify best practices. These activities have been used to support forensic science disciplines such as: arson; digital and multimedia forensics; DNA; fingerprints; firearms and toolmarks; odontology; controlled and dangerous substances; toxicology and trace analysis. A high level description of many of NIST's ongoing forensic science projects will be presented which includes:

- Expert Working Group on Human Factors in Latent Print Analysis
- Personnel Selection Tool for Latent Prints
- Expert Working Group on the Preservation of Biological Evidence
- 3D Topography Correlations of Bullets and Casings
- Photo scales and Forensic Photogrammetry
- Computer Forensics
- NIST OLES's Research on the Scientific Working Groups
- Upcoming publications

New Biological Evidence Training for Investigations

Bonnie Cheng, Oakland PD Crime Laboratory

Biological evidence has played a major role in solving cold cases, identifying missing persons or unknown individuals, and providing leads in homicide, sexual assault, and burglary cases. Crime scene investigators, criminal investigators, and district attorney investigators each play a vital role in the collection of biological evidence recovered in a criminal case. These different investigative units are often compartmentalized and the investigators are not aware of the upstream or downstream role biological evidence plays in the overall investigation.

Techniques in the collection and processing of DNA evidence are advancing at a tremendous rate. Law enforcement personnel need to be constantly enlightened to these advances; however, a gap exists in training for law enforcement personnel who come into contact with or utilizes biological and DNA evidence as a tool during the investigation of a case.

DNA Evidence for Investigators is a course developed with input from DNA analysts, district attorneys, crime scene personnel, and police officers on how to train criminal investigators on effective DNA uses. The purpose of this course is to close the gap by teaching investigators what, why, and how evidence is processed from various criminal incidences (i.e. homicides, sexual assaults, burglaries, robberies) and how to more effectively use the laboratory analysis to further their investigation. This 24-hour interactive course addresses the role biological evidence plays in a criminal investigation from crime scene to adjudication.

Exploring the Capabilities of Mixture Interpretation Using the True Allele Software

Michael D. Coble and John M. Butler

DNA mixtures from sexual assault evidence or high volume crimes such as burglaries can be challenging for the forensic scientist to interpret. The problem is exacerbated when the evidence contains more than two contributors or is highly compromised due to DNA degradation. Guidelines for mixture interpretation developed by Clayton et al. (1998) have been widely accepted and serve as a logical step-wise model to interpret mixtures.

Laboratories have developed "in-house" spreadsheets or have purchased commercial software to rapidly calculate the multiple parameters necessary for mixture interpretation using the Clayton et al. method (e.g. peak height ratio, mixture ratio, etc.). Additionally, mixture software can be used to calculate statistics using either Random Man Not Excluded (e.g., combined probability of inclusion, CPI) or Combined Likelihood Ratio (CLR) to evaluate the data.

We have evaluated the True Allele Software (CyberGenetics, Pittsburgh, PA, USA) by analyzing an assortment of two-, three-, and four-person mixtures. The software uses quantitative probabilistic genotype modeling of the data to form a joint LR statistic for the weight of the evidence. We examined a series of controlled two-person mixtures with differing contributor ratios and a broad range of allele sharing between the samples to determine the efficacy and reproducibility of the software. For complex mixtures, we examined the gain in information (measured by the log LR) compared to data evaluated with CPI and CLR statistics.

The Role of Next Generation DNA Sequencing in Forensic mtDNA Analysis

Dr. Mitchell Holland, Penn State University

Current practices for performing forensic mitochondrial DNA (mtDNA) sequence analysis, as employed in public and private laboratories across the United States, have changed remarkably little over the past 20 years. Alternative approaches such as next-generation sequencing, have been developed and proposed, and these new technologies have the potential to streamline the testing process, interpret heteroplasmy, and deconvolute mixed mtDNA profiles. The role of these NGS methods, laboratory experience and results in forensic mtDNA analysis will be discussed. Source: www.mitotyping.com/mitotyping/lib/mitotyping/FSR_Paper_2012-2.pdf.

Whole Mitochondrial Genome Sequencing Using Probe Capture and 454 Next Generation Sequencing

Valerie McClain^{1,2}, Cassandra Calloway², George Sensabaugh³
¹University of California, Davis, ²Children's Hospital Oakland Research Institute, ³University of California, Berkeley.

Next-generation sequencing (NGS) technologies are emerging as powerful tools for biomedical research and clinical applications and have the potential to revolutionize forensic DNA analysis. NGS technologies are characterized by parallel determination of hundreds of thousands to millions of short sequence reads (100-500 bp) in a single run. NGS can be used for direct sequencing of DNA products generated by PCR, of DNA fragments generated from intact DNA, or of DNA fragments occurring as a consequence of environment degradation. Of the several NGS technologies are available, the 454 sequencing technology currently appears to be the most suitable for forensic applications because it can directly sequence 400-500 bp lengths of DNA. The 454 Genome Sequencer is a scalable, highly parallel pyrosequencing system that uses emulsion-based PCR for 'clonal' amplification of single DNA sequences. The 'clonal sequencing' aspect of this technology allows both sequencing of DNA present in very low quantity and quantitative detection of variants present in less than 1% in a mixture.

Mitochondrial DNA (mtDNA) sequence analysis is of proven value in forensic cases where samples are degraded and nuclear STR testing cannot produce a complete discriminating profile. A central technical challenge in forensic mtDNA analysis is to selectively generate mtDNA sequences from samples containing a preponderance of nuclear genomic DNA. The standard approach is to selectively amplify mtDNA sequence regions of interest which are then directly sequenced, whether by conventional Sanger sequencing or more recently by NGS.

We describe here a novel alternative approach to mitochondrial DNA (mtDNA) sequence analysis by NGS which employs a liquid phase hybridization probe capture system to selectively capture mtDNA fragments from whole genome DNA samples. We use the Nimblegen SeqCap EZ platform due to its extensive tiling design and ability to efficiently synthesize hundreds of thousands of probes. To increase the specificity of our probes, we considered the circular nature of mtDNA, the high density and distribution of sequence polymorphisms, and nuclear pseudogenes in our probe design strategy. Our final design covers 99.9% of the mitochondrial genome with unique

probes. For the NGS, we use the 454 NGS platform due to the longer read length (~500bp) and the affordability of the 454 GS Junior system for forensic laboratories.

Our results show successful capture of 100% of the mitochondrial genome of all samples with coverage adequate to yield unambiguous sequence assignments with an average on target capture rate of 75%. Multiple samples have been tested to evaluate the specificity of our assay; all SNPs previously detected by Sanger sequencing were also detected by 454 sequencing. We have tested the sensitivity of our method by reducing the starting amount of DNA to forensically relevant DNA levels (<1ng sample DNA) with no loss in sequencing accuracy. Our method also achieved resolution of mixtures below the limits of Sanger sequencing (<10%). To improve efficiency, the probe capture hybridization time was reduced from the manufacturer's recommendation of three days to one day. This greatly improves the throughput of the capture method, without affecting the on target capture rate, or accuracy of the capture probes. In conclusion, we have successfully developed a method for whole mitochondrial genome capture followed by NGS which can be applied to the field of forensic science.

Applications of Ion Torrent PGM™ in Human Identification

Robert Lagacé, Sharon Chao Wootton, Reina Marie Langit, Walter Parson, Lori Hennessy, Life Technologies

The field of human identification has been dominated by capillary electrophoresis-based (CE) STR fragment analysis. There has also been a minor effort to sequence the hypervariable regions I/II of the mitochondrial genome by CE. The low throughput of CE sequencing makes it difficult to incorporate complex DNA testing into routine procedure for criminal labs. Next-generation DNA sequencing technologies have advanced dramatically in recent years, although the high costs to setup and operate these technologies have slowed adoption by criminal labs. With the recent launch of the Ion Torrent PGM™, applications of more complicated contents can be designed for the forensic community to take advantage of the low cost and high throughput features that the PGM™ provides.

The whole 16 kb mitochondrial genome can be sequenced on one chip on PGM™. If sequenced on CE, 64 separate reactions would be necessary (assuming 500 bp amplicons and forward/reverse sequences). We can simultaneously sequence whole mitochondrial genomes from 25-50 individuals on one 316 chip. It is also possible to combine many currently used STR kits such as Identifiler, Yfiler, NGM Select, as well as phenotypic SNPs, autosomal SNPs, Y SNPs, and Indel markers into one testing kit.

To test the feasibility of this idea, we have built an assay system in which we designed 32 PGM™ A fusion adaptors with a short sequence tag made of different combinations of nucleotides attached to the A adaptor (barcode). We have amplified the whole mitochondrial genome with 2 PCRs each yielding overlapping 8-9kb amplicons. The two PCR products were then combined, sheared, and ligated to P1 and A-fusion bar coded adaptors. The PCR products from each individual can then be pooled and sequenced on the PGM on one chip. Additionally, for more compromised samples, we have created a 2 PCR mitochondrial mini amplicon system consisting of 2 multiplexes of 5 primer sets spanning the mitochondrial control region.

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To demonstrate feasibility of the SNP assay, we have constructed a panel of 103 autosomal and 35 Y chromosome SNPs selected from publicly available datasets. A single PCR multiplex for ~200 bp amplicons covering the 138 SNP loci has been generated using the AmpliSeq™ Designer pipeline. The PCR products were ligated to P1 and A-fusion bar coded adaptors. Bar coded libraries from 32 individuals were pooled and sequenced on one chip on the PGM™ and compared to reference genotypes.

Exploding Targets

Samantha Peek, John D. Jermain, Brittany M. Crane, Bureau of Alcohol, Tobacco and Firearms

Firearm enthusiasts train with exploding targets to improve their accuracy and for recreational purposes. When a bullet makes contact with a target, the container will explode on impact. An exploding target is a type of binary explosive consisting of an oxidizer (i.e. ammonium nitrate) and a fuel (i.e. aluminum powder). As part of our research, we are analyzing various mixtures of exploding targets utilizing Scanning Electron Microscope/ Energy Dispersive Spectroscopy and X-ray Diffraction to ascertain what material is present in the binary explosive mixture.

Exploding targets currently do not have any regulation within the government and there are no laws indicating it is illegal to make the binary explosive, as long as the targets are not transported. It is important we research the targets because these are binary explosives that are highly unstable and dangerous if able to detonate on impact from a bullet.

Fiber Evidence: A Case Study

Peter Barnett, Forensic Analytical Sciences, Inc. and Skip Palenik, Microtrace

Fibers that are transferred from one object to another can be evidence of contact between the two objects. Fibers from two different objects in the home of an apparent abduction and murder victim were recovered from a suspect's vehicle. A total of approximately 17 different fibers recovered from tape lifts from the suspect's vehicle were found to be indistinguishable from fibers from two objects in the victim's residence. A variety of analytical tests were performed on these fibers and the results of those tests will be presented. The analytical tests provide strong evidence that the fibers could be from the two items from the victim's residence, or any similar items. Are we answering the right question? How do we address other questions in this case? The question relevant questions is, "Are these fibers from the recovered objects?" Does the forensic scientist have any obligation to address this question? Assuming that the question can be addressed, the next question is "How did the fibers come to be present in the suspect's vehicle?" Does the forensic scientist have an obligation to answer that question. One of the authors (Palenik) will present the analytical results leading to the conclusion that fibers from the vehicle could have come from the recovered objects. The other author

(Barnett) will address the question of how that evidence can be evaluated, and address the obligation of the forensic scientist to attempt to answer the question of the significance of the evidence.

NIST Bullet SRM 2460 Replication and Validation Using an Improved Vacuum Casting Method and Potential Evidentiary Use

R.M. Thompson, A. Zheng, B. Renegar, J. Song, J. Yen, and T. Vorbuerger, Law Enforcement Standards Office & Surface and Nanostructure Metrology, NIST

In 2011 the Law Enforcement Standards Office (OLES) at NIST entered into technology transfer agreement with the German Bundeskriminalamt (BKA) whereby NIST could use their current polymer replication method to produce the next generation of NIST Bullets (SRM 2460). Within a few months the NIST Project Team had adapted the process using polymer materials more easily obtained in the United States. The replica bullet surface profiles were measured using the same exacting methods used to qualify the Bullet SRMs. Results of those comparisons reveal that the cast replicas are virtually identical to the original SRM bullet that was cast. Another casting procedure is being developed for cartridge cases, bullets, and toolmarks that will be more "crime lab friendly" in materials and hardware. In this way crime laboratories may have the option to make replicas of evidence using a tested and accurate process. These replicas could be shipped to another agency for analysis without the risk of losing the original evidence. Additionally, proficiency/training sets can be produced that are identical in quality to the original items. The European Network of

Forensic Science Institutes Expert Working Group on Firearms and GSR (ENFSI EWG FA/GSR) has sponsored proficiency tests using the vacuum casting method with great success.

Proposed "NIST Ballistics Identification System (NBIS)" Based on 3D Topography Measurements on Correlation Cells

Jen-Feng Song, Wei Chu, Robert M. Thompson, Law Enforcement Standards Office - NIST

The proposed "NIST Ballistics Identification System (NBIS)" using 3D topography measurements on correlation cells can facilitate high accuracy and fast ballistics identification and evidence searches. The correlation cells can identify "valid correlation areas" and eliminate "invalid correlation areas" from identification. The proposed "synchronous processing" can significantly increase correlation speed. Based on the concept of correlation cells, a Congruent Matching Cells (CMC) method using three identification parameters is proposed for ballistics and toolmark identifications and for high accuracy and fast ballistics evidence searches. The proposed method can be used for correlations of both geometrical topographies and optical intensity images. All the parameters and algorithms are in the public domain and subject to open tests. An error rate reporting procedure can be developed that can greatly add to the scientific support for the firearm and toolmark identification specialty, and give confidence to the trier of fact in court proceedings.

PANEL: Bridging the Generations

Raymond Davis, Moderator, Keith Inman, Wayne Moorehead, John Houde, Greg Matheson, and Dr. Norah Rudin

Keith Inman:

As we sit at the bench hacking the next swab, scraping the next pill, or taping the next garment, we probably do not think of our work as requiring any courage on our part. We have the protocol in front of us, a shelf full of binders proving the mettle of our work through accreditation and validation, and a supervisor who reviews all of our work, ensuring that we have evaded the land mines. We have what we need.

Conversely, think for a moment about the origins of the CAC; now that was a courageous bunch. This organization was started by 13 men who felt that their expertise, skill, knowledge, and general ability to fulfill their function was impaired if they could not interact with one another. At the first meetings (where they frequently hosted each other at their PERSONAL HOMES) they could discuss their successes, their failures, and how the field could advance. They were never funded by their agency. Ever. Now that took courage, and we no longer feel the need for such pluck, do we?

It is certainly seductive to believe that we are surrounded by a safety net; the protocol, the certificates and diplomas on the wall, the terabytes of data and literature supporting our conclusions, all point to our feet situated on solid ground. Until our supervisor tells us to analyze this piece of evidence, because the captain says so. Or our sample becomes contaminated when someone forgets, or neglects, to clean the space or implements properly. Or when it is lab policy to never talk to the detective about the needs of the case. Or when an attorney suggests that we use *this* word instead of *that* one because it sounds better to the jury, and is more in line with legal jargon. Or when a detective, at an officer involved shooting, forbids you to collect a specific, relevant piece of firearms evidence. Or when we discover, on the witness stand while giving testimony, that we have misplaced a decimal point in our quantitation. And then, suddenly, we need to start channeling *Braveheart*.

One of my hard-won aphorisms goes something like this:

We don't matter; only the evidence matters. Our embarrassment, censure, counseling, and reprimands don't matter. Only the accurate portrayal of the physical evidence and its meaning matters.

And it takes massive and daily courage to make that our priority over everything else.

Wayne Moorehead:

I have been known at times to ask questions; sometimes, too many questions. So rather than tell you what I think I'm going to ask you some questions that I don't need to hear the answers to right now, but the answers you should begin to explore.

Why are you in this profession?

Is this a job or a career/profession to you?

Do you work at the level of a technician or a scientist? Would an experienced peer agree?

Do you perform only what is asked or do you explore, question, and provide more service than asked?

Are you reading scientific literature, forensic or otherwise, when you are not being paid to do so?

If you see potentially relevant evidence, do you alert the investigator, attorney, or perhaps another scientist to its presence?

When appropriate, do you explore hypotheses other than the one proposed by the investigator or attorney? Do you discuss the alternatives with them?

Would you want your physician to have the same attitude about their profession that you do toward yours?

If you were arrested, would you want you working on your case?

Are you sharing your casework and courtroom knowledge/experience with others?

Would you attend a meeting on your own time and money?

Assuming there was no explicit support or rejection by management, would you do research and give a technical presentation on that research at a meeting?

Do you find seeking advice from peers to be a sign of weakness? Would your peers or supervisor?

What is the most difficult aspect of your work? How could you make it less difficult?

Is there a better way to do the analysis without compromising quality or forensic integrity?

How would you improve the CAC, these seminars, or the profession?

Has management/supervisors discouraged you from attending or presenting at meetings or performing beyond the minimal on the evidence request?

Do you know and understand ISO 17025 and ASCLD-LAB or FQS accreditation requirements?

After today, how will you change or what will you change to become a more valued member of the forensic community?

How can we help you to achieve the potential we see in you?

John Houde:

The field of criminalistics is a-changin'. All areas of human endeavor change, but science and technology is particularly prone to rapid evolution. My first major in college was medical technology until I saw first-hand how mundane that job could be. I pursued a career in criminalistics because I felt it was one of the few remaining jobs that allowed freedom of creativity and independence of thought. When it's just yourself at the crime scene or on the witness stand, you must rely on your wits, experience and high ethical standards. Today I wonder how many criminalists even expect to go to a crime scene or testify in court. Some specialty areas of the lab don't allow bench-level personnel to interpret the results of their own analysis. I fear "medical technology" has come to the crime lab.

The experiences of the next generation of criminalists will be as different from mine as mine were from my father's generation. I heard him tell crime lab stories (he was police photographer) and felt envious of those "wild west" days of early forensic science. Everything they did was groundbreaking. My generation saw the introduction of certification, accreditation, government oversight, proficiency testing, and DNA testing. The next generation won't recall the days before O.J. and CSI swung the public spotlight onto the profession. It's always hard to endure the loss of freedom, but the next generation will take it in stride. Will their career be as much fun?

Norah Rudin:

When a group with similar social and professional attributes gathers, the discussion inevitably devolves (or perhaps degenerates) into dichotomies and stereotypes: us vs. them, our values and qualities vs. their values and qualities. On a recent occasion, a group forensic scientists of a certain age and professional sensibility illustrated this precept. We began with a discussion of our generation vs. their generation and continued to delineate attributes that we felt defined us vs. them. This categorization, the very essence of stereotyping, began to lead us down a dark and convoluted rabbit hole.

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While differences certainly exist between any two groups that one might choose to define, it is also true that those differences exist along a continuum, including outliers at both ends of the normal curve. The challenge, as I currently see it, how do we facilitate intentional and voluntary communication between, not only the generations, but between public and private labs, and between government and independent analysts. The gulfs are as wide and sometimes appear as impassable. I propose these ideas as part of our ongoing discussion.

Raymond Davis:

There were two important times in my life where the experience of others helped to shape my professional life. The first was in the military and the second, at beginning of my forensic career. I was an infantry officer during the Viet Nam war working closely with senior non-commissioned officers. No matter how well I had been trained, I was worried about doing my best. Whenever I encountered a difficult problem or received a command I felt challenged to complete, I sought the counsel of these old warriors. I was surprised and delighted by their attitude making my time in the service an incredible experience. I have never forgotten how important it is to ask for help and I encourage you to do the same when faced with a new challenge.

I began my career with DOJ forty years ago in a refurbished cannery located at 3301 C Street in Sacramento. I didn't even know the word criminalistics until a few months before starting the my career. Because of limited laboratory space, we had to double up by starting our training classes at noon and finishing at eight during the three week blood alcohol course. One of the clearest memories I have of those times was the generosity of the technical staff as they guided us through our training. They answered our questions and encouraged us along the way. Our instructors were just as committed to our success making our training a memorable experience. Reflecting back, I am grateful for the wisdom and advice of the people who have contributed to my success.

Dan Gregonis:

Fact is Fact but Perception is Reality; this is something I heard Dr. George Sensabaugh say at a CAC meeting many years ago and it has stuck with me ever since. **Are the perceptions of the "seasoned" criminalists correct in thinking that new criminalists are not interested in learning from the old? Do the new "New Silent/Generation Z" or "Y-Generation" criminalists think they know it already or that their immediate peers know better than those with years of experience? Is it simply a matter that the new and the older experienced criminalists don't know how to communicate effectively with each other?** We've identified this as a new problem but perhaps this is a reoccurring thought by the next generation to fill each of these roles and maybe Tony Longhetti thought the same about me when I entered the field.

The subject of passing along gained knowledge i.e., our experiences, mutated into talk about mentoring while a group of "seasoned" criminalists had dinner one evening last spring. Some of the frustration spoken about had to do with a perceived reluctance by the new criminalists to learn from the experiences of the older criminalists. **Does the new generation view the experienced criminalists any different than Wikipedia when it comes to a source of information?** We certainly hope not but the internet is so easy to access.

We certainly think that our knowledge, gained through study and experience, is much more valuable and in depth than the Wikipedia version and certainly worthy of passing along to the next generation of forensic scientists. Plus the biggest learning experiences I've had has been through one on one or group discussions about different issues. Hopefully these discussions have taught me how to think about the issues, not just gather facts.

Why should new criminalists learn things the hard way when there is a ready living source of information available?

If new criminalists learn the hard earned lessons directly from the experienced analysts then they will have time to explore new areas and be able to pass along their new information and knowledge to other criminalists, new and old. I learned early on through interns and trainees that I've had that I can learn something from everyone I run in to. Sometimes those lessons are small, sometimes large but it all adds up to a wealth of experience and knowledge. It also adds up to the fact that the more I learn, the more I realize I don't know.

Greg Matheson:

Compared to the others in this group my career took a somewhat different path. I worked the bench for 11 years in the areas of Toxicology, Crime Scene Analysis, Poisons and explosives analysis and mostly Serology. In my 12th year I was promoted to a supervisor (in a laboratory which was large enough that supervisors rarely performed casework), then an assistant laboratory director and eventually laboratory director. My perspective of the evolution of generations in the crime laboratory is by necessity somewhat different.

There have been many changes in the world since I started as a criminalist in 1978. All of those changes have the potential to affect how people do their jobs, how they view professionalism and whether they choose to make their money earning activities a job or a profession. It's important for those of us who have been in the profession for several decades to give some thought and consider how we might be serving our profession if we entered the field today and then use that enlightenment to make us better mentors and leaders.

As an example, if you consider only the changes in the laws that govern work we can see how today is a very different world for employees and employers and could affect how the current generation of criminalists view and approach their work. Not many years ago, to be considered a dedicated professional you stayed after work as needed, on your own time, to finish an experiment or you took literature home with you to ensure you completed study required by your laboratory to learn a new technique or procedure. However, starting about seven years ago, as a Laboratory Director I was required by the federal Fair Labor Standards Act and the policies of the Los Angeles police Department to discipline any employee who continued to work past their end of watch without prior approval, even if it was as little as six minutes extra to finish writing up their notes, wrap up an experiment, or clean their bench. Though this sounds absurd and seems like it can only result in crushing people's desire to go the extra mile and do what is necessary to get the job done right (be a dedicated professional), it became a necessity due to changes in the work place. It is our job as supervisors and managers to help people accomplish what needs to happen while maintaining interest and professionalism and meeting legal requirements.

We need to learn how to adapt to the changing conditions of work and life while using our experience, commit-

ment, and knowledge to help the profession and new generations of criminalists move forward and improve without bemoaning what we perceive as negative change.

Use of Quantifiler Duo to Screen Sexual Assault Evidence

Adam Dutra, San Diego PD Crime Laboratory

Traditionally, the San Diego Police Department has used microscopic examination for the detection of sperm cells as a method to screen sexual assault examination evidence for suitability for DNA testing. Although the quantity of sperm cells can be used as a rough estimate of the amount of male DNA in a sample, male DNA can come from body fluids other than semen. Additionally, microscopic examinations are time intensive and attempts to automate the process are costly and have had mixed success. SDPD uses Quantifiler Duo to quantify both human and male DNA simultaneously and has recently employed this DNA quantitation method to screen sexual assault evidence in lieu of microscopic screening. This presentation will provide some of our motivations for this change, brief descriptions of our prior and current procedures, highlights of our validation, and a few notable successes to date.

ArmedXpert™: A Software Tool for Mixture Deconvolution and Case Management of STR Results

Rhonda K. Roby, PhD, MPH, Institute of Applied Genetics, University of North Texas Health Science Center, Dept. of Forensic & Investigative Genetics; , and Dennis J. Reeder, PhD, Reeder Analytical Consulting, LLC

ArmedXpert™ (NicheVision Forensics, LLC, Akron, OH) is a mixture deconvolution software program that also contains many features for casework management. ArmedXpert is designed to automate the tedious and numerous calculations required to thoroughly review a mixed STR DNA result. This software not only aids the forensic DNA analyst in these routine, time-consuming computations but it also provides an array of significant other functions. ArmedXpert has a user-friendly interface to import tabular data, to compare sample results, to identify matches within a case file and in multiple databases, and to conduct critical quality control evaluations. The quality control interface allows the user to check ladders, check controls, and detect possible stutter. The software performs matching between evidence samples and references and evaluates possible contamination by staff. The software is designed to perform CODIS functions; conduct mixture interpretation with two to three contributor mixtures; view simulated electropherograms; chart data; perform various biostatistical analyses for single and multiple source samples; and print and save data.

ArmedXpert is a software program that can be easily adapted and implemented into the forensic analyst's toolbox. This program has many features that will assist forensic analysts to fully evaluate and summarize their data. ArmedXpert can be used as a stand-alone program or can support DNA analysts in their arduous task of mixture interpretation and used in conjunction with other software programs.

In this presentation, various examples will be shown to demonstrate the ease and power of the software. The attendee will gain an understanding of the need for a deconvolution

software tool and the advantage of having many tedious calculations being made nearly instantaneously.

Comparing Wearer DNA Sample Collection Methods for the Recovery of Single Source Profiles

Corissa J. Harris, Amanda J. Cardenas, Steven B. Lee, San Jose State University and Brooke Barloewen, Santa Clara County Crime Laboratory

Wearer DNA is the deposit of epithelial cells on clothing worn by an individual. Detection of the last individual to handle or wear an item is often an important determination in forensic science. The most commonly used collection methods for wearer DNA include swabbing and scraping. These often result in mixture profiles. The detection of a single individual who last wore or came in contact with an item is desirable. Recently, adhesives have been introduced as a possible reliable method for the collection of biological evidence. Adhesives have a tendency to recover less, but more recently deposited particulate than the current methods because they are less invasive. The ability to observe the collected cells with the aid of a microscope is another advantage of using adhesives.

The goal of the research was to compare the current collection methods of swabbing and scraping with a gel film called Gel-Pak '0' which shares similar properties with adhesives. Gel-Pak '0' has been previously studied in comparison to other adhesives for the collection of epithelial cells, and was shown to recover the top layer of loose particulate. This particulate was deposited by the individual who last came in contact with an item. Therefore, in comparison to the other two collection methods, Gel-Pak '0' was hypothesized to recover single source profiles on clothing items from the most recent wearer. DNA analysis was performed on samples collected by the three methods from various clothing items including baseball hats, t-shirts, sweatpants, socks, and other items commonly submitted to crime labs for DNA analysis. The habitual wearer and second/last wearer wore each item for a predetermined time.

The results of the research showed that Gel-Pak '0' recovered a similar number of CODIS (local and national) eligible profiles as swabbing. However, coupled with the fact that it is time consuming, costly, and cannot be used on all surfaces, Gel-Pak '0' was determined to not make for an effective collection method of the most recent wearer's DNA. Therefore, Gel-Pak '0' will not be considered for casework. Although Gel-Pak '0' will not be further used, the results did reveal some trends that may shed light on how DNA analysts may approach wearer DNA cases. Swabbing had a tendency to yield smaller amounts of DNA but obtain DNA from the last wearer of the piece of clothing more effectively than the other two methods. Scraping had a tendency to yield a greater quantity of DNA but obtain mixtures, including more DNA from the habitual wearer due to its invasive nature. Revealing individuals who last wore an item can be of great importance in forensic science, and therefore, further research with various adhesives and gel films could be vital for solving forensic investigations.

Overcoming Inhibition with PCR Enhancers

Phil Nhan, Hanna Bennett, Hillary Nguyen and Steven B. Lee, San Jose State University

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Since its introduction in the mid-1980s, the use of DNA, namely DNA profiling, in forensic science has revolutionized the justice system on a worldwide scale. DNA profiling is comprised of multiple steps and procedures including DNA extraction, quantification and amplification using Polymerase Chain Reaction (PCR). PCR has permitted the analysis of very low quantity, low quality DNA samples. However, crime scene samples are often found in very poor condition and are often mixed with extraneous materials that may co-extract with the DNA.

There are several known, commonly encountered inhibitors to PCR: calcium, collagen, humic acid, hematin, melanin, indigo dye, detergents and phenol-chloroform used in DNA extractions. These inhibitors may interfere with the cell lysis or capture of components necessary for DNA extraction by causing DNA degradation and/or inhibiting DNA polymerase amplification of target DNA. A 2012 review on forensic implications of PCR inhibition was published.

Although the causes of PCR inhibition are still not fully known, three mechanisms have been proposed. These include: 1) binding of inhibitor to Taq polymerase; 2) blocking of amplification sites due to inhibitor-template binding; and 3) decreasing processivity due to interaction of the inhibitor with Mg²⁺ cofactors or other components of PCR.

Detection and overcoming PCR inhibition are critical challenges faced by forensic molecular biologists and many others such as microbiologists studying soil samples, molecular evolutionary biologists studying ancient remains and preserved samples, molecular ecologists studying animal excrements, molecular pathologists studying preserved and mounted specimen, and molecular archaeologists and anthropologists studying ancient human remains.

Commonly utilized methods for overcoming inhibition in the forensic DNA community include: 1) diluting the samples (thereby also diluting inhibitors in the sample); 2) additional cleaning of the sample by purification; 3) including additional DNA polymerase and Bovine Serum Albumin; 4) utilizing STR multiplexes that are inhibitor resistant such as Minifiler, Identifiler Plus and Powerplex 16HS; and 5) adding PCR enhancers.

In this study, a mutant Taq polymerase and two different PCR enhancers were tested for their ability to overcome inhibition: Omnitag (DNA polymerase technologies, St. Louis, Missouri), PCR enhancer cocktail and PCRboost (Biomatrica, San Diego, CA). Omnitag is an inhibitor-resistant Taq polymerase mutant and PCR enhancer cocktail (PEC) consists of a mixture of nonionic detergent, L-caritine, D-(+) trehalose, and heparin. PCR and STR boost are proprietary enhancers from Biomatrica Inc. Previous tests conducted in our laboratory have shown improved amplification using PCRboost from DNA samples containing indigo dye, hematin, humic acid, and phenol chloroform.

This project will explore the amplification enhancement of Omnitag, PEC and PCR boost on low quantity and low quality DNA samples that contain varying amounts of inhibitors. Enhancement will be evaluated on replicate 1, 0.5 and 0.25ng samples with and without inhibitors at different concentrations using qPCR and STR multiplex typing.

DNA Profiling of Database Reference Samples Using Second Generation Sequencing

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gative Genetics, University of North Texas Health Science Center, 3500 Camp Bowie Blvd, Fort Worth, TX 76107

Fourteen years ago, a core set of forensic markers was selected for the United States national databank, Combined DNA Index System (CODIS). This databank houses over 10,400,000 DNA reference profiles comprised of autosomal STRs from convicted felons and arrestees. These profiles have been used to develop many investigative leads for a variety of crimes. The database size continues to grow and additional search strategies have been considered. The expanded applications that CODIS has experienced over its 14 years warranted a reconsideration of whether the current core loci are sufficient. There is general agreement that the core STR markers for CODIS needs to be increased; but there are differences of opinion on what criteria and how best to proceed with core marker selection. While choosing a core set of markers is useful for formalizing a common set for data exchange, this concrete set inadvertently can limit progress and stifle innovation for alternate markers that may serve well the specialized forensic community needs. However, these discussions on a fixed core set of loci and unintentional stymied growth of novel marker sets can be rendered moot with the advent of second generation sequencing (SGS). With this technology, it is possible to analyze a large battery of forensically relevant genetic markers simultaneously with economies of scale once not thought possible. Furthermore, the high throughput capacity of NGS technology makes possible multiplexing of 12 to 384 individuals in a single reaction. Additional barcodes can increase sample throughput an order of magnitude. Instead of focusing only on a core set, a comprehensive (although small by SGS capabilities) panel of 31 autosomal STRs, 26 X STRs, 29 Y STRs, and 378 forensically relevant SNPs (both identity and bioancestry) was created using two separate sample preparation methods: TruSeq by Illumina and HaloPlex by Agilent Technologies. Analysis was carried out on an Illumina GAIIx instrument which has a throughput in 50-100 gigabase range and far surpasses coverage requirements.

Forensic Face Matching: The Pitfalls and Promise of Comparing Suspect and Surveillance Images When Crimes are Recorded on Camera

David DeGusta, Organization: Better Forensics

The proliferation of surveillance devices has led to an increasing number of criminals being recorded on camera in the course of committing a crime. When a suspect is apprehended in such cases, a key question is whether the suspect is the same person pictured in the surveillance imagery. This presentation will review methods for testing the hypothesis that an arrested suspect is the same person recorded committing a crime. Qualitative, quantitative, superimposition, and automated approaches will be evaluated. Facial, ear, and postcranial metrics will be included, along with a consideration of the most appropriate statistical tests. Some significant pitfalls in published methods will be described, and a rarely used source of data identified. The goal is to develop a robust protocol for handling forensic photo comparisons that can assist practicing criminalists and serve as the basis for further research.

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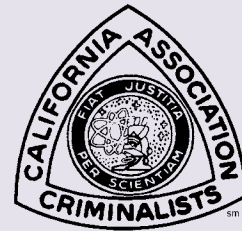


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